The Contribution of Income Components to Income Inequality in South Africa

A Decomposable Gini Analysis
No. 51 Strauss and Mehra, *Child Anthropometry in Côte d'Ivoire: Estimates from Two Surveys, 1985 and 1986*

No. 52 van der Gaag, Stelcner, and Vijverberg, *Public-Private Sector Wage Comparisons and Moonlighting in Developing Countries: Evidence from Côte d'Ivoire and Peru*

No. 53 Ainsworth, *Socioeconomic Determinants of Fertility in Côte d'Ivoire*

No. 54 Gertler and Glewwe, *The Willingness to Pay for Education in Developing Countries: Evidence from Rural Peru*

No. 55 Levy and Newman, *Rigidité des salaires: Données microéconomiques et macroéconomiques sur l'ajustement du marché du travail dans le secteur moderne* (in French only)

No. 56 Glewwe and de Tray, *The Poor in Latin America during Adjustment: A Case Study of Peru*

No. 57 Alderman and Gertler, *The Substitutability of Public and Private Health Care for the Treatment of Children in Pakistan*

No. 58 Rosenhouse, *Identifying the Poor: Is “Headship” a Useful Concept?*

No. 59 Vijverberg, *Labor Market Performance as a Determinant of Migration*

No. 60 Jimenez and Cox, *The Relative Effectiveness of Private and Public Schools: Evidence from Two Developing Countries*

No. 61 Kakwani, *Large Sample Distribution of Several Inequality Measures: With Application to Côte d'Ivoire*

No. 62 Kakwani, *Testing for Significance of Poverty Differences: With Application to Côte d'Ivoire*

No. 63 Kakwani, *Poverty and Economic Growth: With Application to Côte d'Ivoire*

No. 64 Moock, Musgrove, and Stelcner, *Education and Earnings in Peru’s Informal Nonfarm Family Enterprises*

No. 65 Alderman and Kozel, *Formal and Informal Sector Wage Determination in Urban Low-Income Neighborhoods in Pakistan*


No. 67 King, *Does Education Pay in the Labor Market? The Labor Force Participation, Occupation, and Earnings of Peruvian Women*

No. 68 Kozel, *The Composition and Distribution of Income in Côte d'Ivoire*

No. 69 Deaton, *Price Elasticities from Survey Data: Extensions and Indonesian Results*

No. 70 Glewwe, *Efficient Allocation of Transfers to the Poor: The Problem of Unobserved Household Income*

No. 71 Glewwe, *Investigating the Determinants of Household Welfare in Côte d'Ivoire*

No. 72 Pitt and Rosenzweig, *The Selectivity of Fertility and the Determinants of Human Capital Investments: Parametric and Semiparametric Estimates*

No. 73 Jacoby, *Shadow Wages and Peasant Family Labor Supply: An Econometric Application to the Peruvian Sierra*

No. 74 Behrman, *The Action of Human Resources and Poverty on One Another: What We Have Yet to Learn*

No. 75 Glewwe and Twum-Baah, *The Distribution of Welfare in Ghana, 1987–88*

No. 76 Glewwe, *Schooling, Skills, and the Returns to Government Investment in Education: An Exploration Using Data from Ghana*

No. 77 Newman, Jorgensen, and Pradhan, *Workers’ Benefits from Bolivia’s Emergency Social Fund*

No. 78 Vijverberg, *Dual Selection Criteria with Multiple Alternatives: Migration, Work Status, and Wages*

No. 79 Thomas, *Gender Differences in Household Resource Allocations*

No. 80 Grosh, *The Household Survey as a Tool for Policy Change: Lessons from the Jamaican Survey of Living Conditions*

No. 81 Deaton and Paxson, *Patterns of Aging in Thailand and Côte d'Ivoire*

No. 82 Ravallion, *Does Undernutrition Respond to Incomes and Prices? Dominance Tests for Indonesia*

No. 83 Ravallion and Datt, *Growth and Redistribution Components of Changes in Poverty Measure: A Decomposition with Applications to Brazil and India in the 1980s*

No. 84 Vijverberg, *Measuring Income from Family Enterprises with Household Surveys*

No. 85 Deaton and Grimard, *Demand Analysis and Tax Reform in Pakistan*

(List continues on the inside back cover)
The Contribution of Income Components to Income Inequality in South Africa
The Living Standards Measurement Study

The Living Standards Measurement Study (LSMS) was established by the World Bank in 1980 to explore ways of improving the type and quality of household data collected by statistical offices in developing countries. Its goal is to foster increased use of household data as a basis of policy decisionmaking. Specifically, the LSMS is working to develop new methods to monitor progress in raising levels of living, to identify the consequences for households of past and proposed government policies, and to improve communications between survey statisticians, analysts, and policymakers.

The LSMS Working Paper series was started to disseminate intermediate products from the LSMS. Publications in the series include critical surveys covering different aspects of the LSMS data collection program and reports on improved methodologies for using Living Standards Survey (LSS) data. More recent publications recommend specific survey, questionnaire, and data processing designs and demonstrate the breadth of policy analysis that can be carried out using LSS data.
The Contribution of Income Components to Income Inequality in South Africa
A Decomposable Gini Analysis

Murray V. Leibbrandt, Christopher D. Woolard, and Ingrid D. Woolard

The World Bank
Washington, D.C.
To present the results of the Living Standards Measurement Study with the least possible delay, the typescript of this paper has not been prepared in accordance with the procedures appropriate to formal printed texts, and the World Bank accepts no responsibility for errors. Some sources cited in this paper may be informal documents that are not readily available.

The findings, interpretations, and conclusions expressed in this paper are entirely those of the author(s) and should not be attributed in any manner to the World Bank, to its affiliated organizations, or to members of its Board of Executive Directors or the countries they represent. The World Bank does not guarantee the accuracy of the data included in this publication and accepts no responsibility whatsoever for any consequence of their use.

The boundaries, colors, denominations, and other information shown on any map in this volume do not imply on the part of the World Bank Group any judgment on the legal status of any territory or the endorsement or acceptance of such boundaries.

The material in this publication is copyrighted. Requests for permission to reproduce portions of it should be sent to the Office of the Publisher at the address shown in the copyright notice above. The World Bank encourages dissemination of its work and will normally give permission promptly and, when the reproduction is for noncommercial purposes, without asking a fee. Permission to copy portions for classroom use is granted through the Copyright Clearance Center, Inc., Suite 910, 222 Rosewood Drive, Danvers, Massachusetts 01923, U.S.A.

The complete backlist of publications from the World Bank is shown in the annual Index of Publications, which contains an alphabetical title list (with full ordering information) and indexes of subjects, authors, and countries and regions. The latest edition is available free of charge from the Distribution Unit, Office of the Publisher, The World Bank, 1818 H Street, N.W., Washington, D.C. 20433, U.S.A., or from Publications, The World Bank, 66, avenue d'Iéna, 75116 Paris, France.

Murray V. Leibbrandt is a Senior Lecturer at the University of Cape Town. Christopher D. Woolard is a Lecturer in the Department of Chemistry at the University of South Africa. Ingrid D. Woolard is a Financial Advisor in the South African Department of Finance.
Contents

Foreword ................................................. vii
Abstract .................................................. ix
Acknowledgments ............................................ xi
I. Introduction ............................................. 1
   Data Set ............................................ 2
II. Framework for the Analysis of the Distribution of Income and Welfare Levels ... 4
III. Applying the Analysis to Rural Communities in Former Homeland Areas ...... 11
IV. Concluding Comments ...................................... 19

Appendix .................................................. 21
   "Decomposing" the Gini coefficient ........................................ 21
   The effect of a change in income on the Gini ............................. 22
   Response of the Sen Welfare function ................................... 24

References ................................................. 25

Tables

Table 1. Decomposition of African Income ........................................... 5
Table 2. Effects of a 1 Percent Increase in an Income Component on Income
   Inequality: African Households ............................................ 7
Table 3. Effects of a 1 Percent Increase in a Component on the Sen Welfare Index:
   African Households ..................................................... 10
Table 4. Decomposition of Rural Homeland African Income ......................... 12
Table 5. Effects of a 1 Percent Increase in an Income Component on Income
   Inequality: Rural Homeland African Households .......................... 13
Table 6. Effects of a 1 Percent Increase in an Income Component on the Sen Index
   for Varying Values of Alpha: Rural Homeland African Households ......... 14
Table 7. Comparison of Rural African Homeland Households Below and Above
   the Subsistence Level .................................................. 15
Table 8. Effects of a 1 Percent Increase in an Income Component on Economic Welfare 16
Foreword

Households in developing countries adopt livelihood strategies that often rely on income from a diversity of sources. From a policy perspective it therefore becomes important to understand the relative importance of income sources in driving inter-household inequality and poverty. Recent theoretical advances allow for the decomposition of Gini coefficients by income components as well for an assessment of the impact of changes in income components on the Gini coefficient. These developments therefore go a long way towards providing the technical tools needed to deliver information on the role of income sources to policy makers.

This paper provides an example of this by applying such techniques to South African data derived from a recent Living Standards Measurement Study survey. In doing so the paper extends existing knowledge of South African income inequality. Particular attention is paid to integrating the decomposition work into debates about rural development policy in South Africa.

Lyn Squire, Director
Policy Research Department
Abstract

Much new work has been devoted to deriving and extending decomposable inequality and poverty measures which bridge the gap between description and analysis by throwing light on the processes undergirding inequality and poverty. For example, an application that has obvious policy relevance in the South African milieu is the use of decomposition techniques to partition inequality into within-race group and between-race group components.

This paper pushes forward such a programme by using a decomposition technique based on the Gini coefficient to discern the relative importance of the major income components in determining overall income inequality. Such analysis shows which income components are more important than others in causing income inequality within any racial group or, more generally, within any categorical partition of the total income sample. We extend this technique to include a discussion of the sensitivity of the Gini coefficient to marginal changes in income sources. The use of such a sensitivity analysis in conjunction with the decomposition analysis is very helpful in pointing to key labour market, state welfare and asset ownership patterns that are integral to the generation of inequality in South Africa or any other country with reliable income data. Finally, a welfare index is derived as a weighted combination of average income changes and distributional changes. This index shows how sensitive welfare is to small increases in income from various sources. We illustrate this welfare analysis for a range of different average and distributional weightings.

The paper uses data derived from a Living Standards Measurement Study survey undertaken in 1993 as part of the Project for Statistics on Living Standards and Development in South Africa. The decomposition analysis is first illustrated using all African households. The bulk of the paper then applies our analysis to rural African households in the former homeland areas of South Africa as an example of how such work can make more specific inputs into policy debates. We first look at this rural sample as a whole and then we divide the sample into those households above a Household Subsistence Level and those households below this poverty line. Some concluding comments are then made.
Acknowledgments

Earlier versions of this paper were read at the South African Labour and Development Research Unit (SALDRU) workshop on Statistics for Measuring Poverty held on December 8-9, 1994 in Cape Town and at the South African Economic Society Biennial Conference held on September 7-8, 1995. We thank those who participated in these sessions for their comments. Special thanks are due to Harold Alderman and to Shlomo Yitzhaki for detailed comments on the paper.
I. Introduction

There is a good deal of contention and subtlety attached to the description of inequality and poverty.¹ Yet, at the end of the day, it is the analysis surrounding any descriptive picture that is going to form the basis for policy. Much new work has therefore been devoted to deriving and extending decomposable inequality and poverty measures which bridge the gap between description and analysis by throwing light on the processes undergirding inequality and poverty.²

A recent study by Whiteford and McGrath (1993) on South Africa is representative of this international trend. On the level of description, it provides a thorough review of available historical evidence and also updates this evidence using a sample drawn from the 1991 population census. It moves beyond description in two respects. First, the work contains a number of exercises on the effectiveness of various growth and redistribution scenarios in eliminating poverty. Second, the work decomposes overall inequality in South Africa into within race group and between race group components using the Theil technique. The major conclusion of this exercise emphasizes that within group inequality is at least as important as between group inequality in explaining South Africa's overall inequality. This has certainly surprised South Africa's research fraternity and has highlighted the need to move beyond blunt racial breakdowns to the processes that underlie both the between group and within group inequalities.

Our paper pushes forward such a programme by using a decomposition technique based on the Gini coefficient to discern the relative importance of the major income components in determining overall income inequality. Our analysis does not do what the Theil analysis does and apportion the blame for inequality into "between group" versus "within group". Rather, it shows which income components are more important than others in causing income inequality within any racial group or, more generally, within any categorical partition of the total income sample.

The usefulness of this decomposition is attested to by the fact that such analysis is beginning to be used in a number of areas of economics.³ We extend this decomposition analysis to include a discussion of the sensitivity of the Gini coefficient to marginal changes in

¹ Chapter 3 of Deaton (1994) provides a recent guide to the immense literature surrounding the welfare foundations of inequality and poverty measures.

² Adams and Alderman (1992) review recent work on inequality and Datt and Ravallion (1992) reference and extend the literature on poverty.

³ Adams and Alderman (1992) present an application to Pakistan. See also Aronson and Lambert (1994) for a public finance application and, in the development literature, Stark, Taylor and Yitzhaki (1986) for a case study of Mexico.
income sources. The use of such a sensitivity analysis in conjunction with the decomposition analysis is very helpful in pointing to key labour market, state welfare and asset ownership patterns that are integral to the generation of inequality in South Africa or any other country with reliable income data. In addition, to the extent that one is prepared to be specific about the societal welfare weighting to be accorded increases in average incomes relative to improvements in the distribution of income, the analysis can also be extended to derive a welfare index showing how sensitive welfare is to small increases in income from various sources. We illustrate this welfare analysis for a range of different weightings.

The discussion in the paper will be based on a survey undertaken as part of the Project for Statistics on Living Standards and Development (PSLSD) by the Southern Africa Labour and Development Research Unit at the University of Cape Town with technical expertise given by the World Bank. The next section will therefore briefly introduce this survey. The third section of the paper then presents the theoretical framework for our analysis using a decomposition of African income for illustration. In the fourth section of the paper, we apply our analysis to rural African households in the former homeland areas of South Africa as an example of how such work can make more specific inputs into policy debates. We first look at this rural sample as a whole and then we divide the sample into those households above a Household Subsistence Level and those households below this poverty line. Some concluding comments are then made.

Data Set

The PSLSD survey was conducted in late 1993. The PSLSD survey was intended to give a broad picture of living standards and poverty for the whole of South Africa. It made use of a detailed questionnaire covering various aspects of the household’s economic activities and social attributes. Data were collected for 8848 households in 358 census enumerator districts countrywide. 157 households were excluded because of missing or incomplete income data. Of the remaining 8691 households, 6474 were classified as African, of which 3357 were in rural parts of the former homelands. Total income for each household was divided into six sources:

1. **Remittances**
   - remittances from absent family members and marital maintenance;

2. **Wage income**
   - income from regular and casual employment, including the value of benefits such as subsidized housing and transport;

3. **Agriculture**
   - value of production for sale and own consumption from both commercial and small-scale/subsistence farming;

4. **Capital income**
   - dividends, interest, rent income, imputed rent from residing in own dwelling and private and civil (contributory) pensions;

5. **State transfers**
   - social pensions, disability grants, poor relief, unemployment insurance and child maintenance grants;

6. **Self employment**
   - business profits from both formal and informal activities.

---

4 Such an extension is much less common. In the development literature it only appears to have been used in Stark, Taylor and Yitzhaki (1986).
Clearly, the choice of which income sources to focus on is determined by the context under consideration and the questions that the analysis is addressing. In the rural South African context, the key policy issues revolve around the relative importance of remittances, wage income, state transfers and agricultural income. These sources will therefore be the focus of discussion in this paper. Capital income and self employment are less important in terms of these debates and are both aggregations of a number of income sources that are residual to the issues addressed in the paper. If the paper were focusing on the informal sector or the role of asset ownership in generating inequality, further disaggregation of these two income sources would be necessary.
II. Framework for the Analysis of the Distribution of Income and Welfare Levels

Assume that within the chosen group there are n households deriving income from K different sources (i.e. K different income components). Using notation similar to that set out in Shorrocks (1983: 311), let \( y_i \) denote the total income of household \( i \), where \( i = 1, \ldots, n \) and \( y_k \) the income of household \( i \) from source \( k \), where \( k = 1, \ldots, K \) (thus \( y_i = \sum_{k=1}^{K} y_{ik} \)). Also, let the distribution of total household income be represented by \( Y = (y_1, \ldots, y_n) \) and the distribution of income component \( k \) be represented by \( Y_k = (y_{ik}, \ldots, y_{ik}) \).

Using this notation, the Gini coefficient \((G)\) for the distribution of total income within the group can be defined as:

\[
G = \frac{2 \text{cov}[Y, F(Y)]}{\mu}
\]

where \( \mu \) denotes the mean household income of the sample and \( F(Y) \) the cumulative distribution of total household income in the sample (i.e. \( F(Y) = (f(y_1), \ldots, f(y_n)) \) where \( f(y_i) \) is equal to the rank of \( y_i \) divided by the number of observations (\( n \)) (Stark et al., 1986: 259).

Equation (1) can be rewritten and expanded into an expression for the Gini coefficient that captures the "contribution to inequality" of each of the \( K \) components of income. (See Appendix.) Using the notation of Stark et al. (1986: 259), the Gini coefficient can be written as:

\[
G = \sum_{k=1}^{K} R_k G_k S_k
\]

where:
- \( S_k \) is the share of source \( k \) of income in total group income (i.e. \( S_k = \mu_k / \mu \)),
- \( G_k \) is the Gini coefficient measuring the inequality in the distribution of income component \( k \) within the group, and
- \( R_k \) is the Gini correlation of income from source \( k \) with total income,\(^5\) defined as:

\[
R_k = \frac{\text{cov}[Y_k, F(Y)]}{\text{cov}[Y_k, F(Y_k)]}
\]

Equation (2) effectively tells us that the effect of source \( k \) income on total income inequality can be broken down into three components:

\(^5\) In essence, \( R_k \) is a form of rank correlation coefficient as it measures the extent to which the relationship between \( Y_k \) and the rank distribution of total income coincides with the relationship between \( Y_k \) and its own rank distribution.
(a) the share of income component $k$ in total income (captured by the term $S_k$);  
(b) the inequality within the sample of income from source $k$ (as measured by $G_k$); and  
(c) the correlation between source $k$ income and total income (as measured by $R_k$).

The larger the product of these three components, the greater the contribution of income from source $k$ to total income inequality. However, it must be noted that while $S_k$ and $G_k$ are always positive and less than one, $R_k$ can fall anywhere on the interval (-1,1]. When $R_k$ is less than zero, income from source $k$ is negatively correlated with total income and thus lowers the overall Gini measure for the sample.

Using this decomposition of the Gini coefficient for total income, it is possible to discuss how a change in the magnitude of income from any particular source affects total income inequality within the group.

Table 1 illustrates this decomposition technique for African income. For example, we see that wage income is the income component which contributes most to inequality. Wages and salaries make up 68.1 percent of total income, the Gini coefficient for this component taken on

<table>
<thead>
<tr>
<th>Income source</th>
<th>Proportion of households receiving income source ($P_k$)</th>
<th>Share in total income ($S_k$)</th>
<th>Gini for income source for households receiving such income ($G_{ik}$)</th>
<th>Gini coefficient with total income rankings ($R_k$)</th>
<th>Contribution to Gini coefficient of total income ($S_kG_kR_k$)</th>
<th>Percentage share in overall Gini</th>
</tr>
</thead>
<tbody>
<tr>
<td>Remittances</td>
<td>0.314</td>
<td>0.071</td>
<td>0.491</td>
<td>0.840</td>
<td>0.021</td>
<td>0.001</td>
</tr>
<tr>
<td>Wage income</td>
<td>0.608</td>
<td>0.681</td>
<td>0.434</td>
<td>0.655</td>
<td>0.887</td>
<td>0.396</td>
</tr>
<tr>
<td>Capital income</td>
<td>0.660</td>
<td>0.057</td>
<td>0.713</td>
<td>0.811</td>
<td>0.567</td>
<td>0.026</td>
</tr>
<tr>
<td>State transfers</td>
<td>0.271</td>
<td>0.107</td>
<td>0.244</td>
<td>0.795</td>
<td>0.158</td>
<td>0.013</td>
</tr>
<tr>
<td>Agriculture</td>
<td>0.236</td>
<td>0.021</td>
<td>0.710</td>
<td>0.931</td>
<td>0.335</td>
<td>0.007</td>
</tr>
<tr>
<td>Self-employment</td>
<td>0.119</td>
<td>0.063</td>
<td>0.651</td>
<td>0.958</td>
<td>0.611</td>
<td>0.037</td>
</tr>
<tr>
<td>Total</td>
<td>0.996</td>
<td>1.000</td>
<td>0.478</td>
<td>0.480</td>
<td>1.000</td>
<td>0.480</td>
</tr>
</tbody>
</table>

6 Under other circumstances $S_k$ could be negative, for example when discussing the share of a tax.
its own is 0.66, and wage income correlates very highly with the overall income rankings \((R_k=0.89)\). Thus we see that \(S_k\), \(G_k\) and \(R_k\) reinforce each other, resulting in a large contribution (82 percent) to the overall Gini. The distribution of wage income (as captured by \(G_{wage}\)) depends partly on the inequality amongst those that are earning wages, but also on the proportion of households with no access to wage income. \(G_{wage}\) is the sum of \((P_k G_k)=0.26\) and \((1-P_k)=0.39\). Thus, it is primarily the latter - the inequality resulting from many households having zero wage income - that contributes to the high Gini for wage income.

If we look at remittance income, we see that the situation is very different. Remittances make up 7.1 percent of total income and the Gini coefficient for remittance income is very high \((G_k=0.84)\) but remittances correlate very poorly with the overall income rankings \((R_k=0.02)\). This is not surprising, as we know that it is generally the poor who are the recipients of remittance payments. The result is a very small positive contribution to the overall Gini - i.e. the weak correlation term considerably reduces the income share and "within component" inequality.

Now, suppose that there is an exogenous increase in income from source \(j\), by some factor \(\sigma_j\) (i.e. \(y_i'(\sigma_j)=(1+\sigma_j)y_i\) for \(i=1,\ldots,n\)). Thus the distribution of income from source \(j\) becomes \(Y_j'=((1+\sigma_j)y_{1j},\ldots,(1+\sigma_j)y_{nj})\). Then it can be shown (see Appendix) that the derivative of the Gini coefficient with respect to a change in income source \(j\) is:

\[
\frac{dG}{d\sigma_j} = - S_j (R_j G_j - G)
\]

If \(dG/d\sigma_j\) is negative then a marginal increase in income component \(j\) will lessen income inequality. This will be the case either when:

(a) income from component \(j\) has either a negative or zero correlation with total income \((-1 \leq R_j \leq 0)\); or when

(b) income from source \(j\) is positively correlated with total income \((R_j > 0)\) and \(R_j G_j < G\).

Alternatively, in order for a marginal increase in source \(j\) income to worsen income inequality it is necessary that \(G_j > G\) (i.e. income from source \(j\) must be more unevenly distributed than total income). However this condition alone is not sufficient for a change in income component \(j\) to worsen overall income distribution as the sign of \(dG/d\sigma_j\) will still be influenced by the strength of the Gini correlation between source \(j\) income and total income (Stark et al., 1986: 260).

If equation 8 is divided through by \(G\), it can be seen that:

\[
\frac{dG}{d\sigma_j} \frac{1}{G} = \frac{S_j R_j G_j}{G} - S_j
\]

Equation (9) states that the marginal percentage change in inequality (as measured by the Gini coefficient) resulting from a small percentage change in income component \(j\) is equal to
component j’s share in total inequality less component j’s share in total income (Stark et al., 1986:260).

Table 2 shows the effects of a 1 percent increase in a particular income component. A 1 percent increase in wage income will increase the overall Gini by 0.07, which is equivalent to a .14 percent increase in the Gini. We immediately notice that an increase in wage or self-employment income will increase inequality, while an increase in any of the other components will reduce the overall Gini coefficient.

A change in remittances, state transfers or wages will have the greatest effect on the overall Gini. In the last case the Gini increases, but in the other two cases it decreases. The sectors which increase inequality were shown in Table 1 to correlate highly with total income rankings which implies that an increase in these sectors will primarily benefit the better off and thus aggravate the Gini.

It can also be seen from the second column of Table 2 that the sum of the percentage changes in the Gini coefficient is zero. This follows because increasing all components of income by 1 percent has no effect on the income distribution and therefore no effect on the Gini.

The final column in Table 2 gives the mean income from each income source and therefore gives an indication of the magnitude of a 1 percent increase in Rand terms. It can be seen that a 1 percent change in average wage income is in fact a R6.90 change but that a one percent change in average agricultural income is only a 21 cents (R0.21) change. Clearly this biases the comparison against the sources with the smallest shares.

<table>
<thead>
<tr>
<th>Income source</th>
<th>Absolute change per 1 percent change in income source</th>
<th>Percent change in Gini coefficient per 1 percent change in income source</th>
<th>Percent change per R10</th>
<th>Mean income (Rand)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Remittances</td>
<td>-0.033</td>
<td>-0.068</td>
<td>-0.952</td>
<td>71.48</td>
</tr>
<tr>
<td>Wage income</td>
<td>0.069</td>
<td>0.143</td>
<td>0.208</td>
<td>689.79</td>
</tr>
<tr>
<td>Capital income</td>
<td>-0.001</td>
<td>-0.002</td>
<td>-0.043</td>
<td>57.67</td>
</tr>
<tr>
<td>State transfers</td>
<td>-0.038</td>
<td>-0.079</td>
<td>-0.729</td>
<td>108.51</td>
</tr>
<tr>
<td>Agriculture</td>
<td>-0.004</td>
<td>-0.007</td>
<td>-0.347</td>
<td>21.29</td>
</tr>
<tr>
<td>Self employment</td>
<td>0.007</td>
<td>0.014</td>
<td>0.216</td>
<td>63.94</td>
</tr>
</tbody>
</table>
To counter this, it is possible to calculate the sensitivity of the Gini coefficient to a small, fixed monetary change in all of the sources. We use a R10 change as a suitable amount. The third column of Table 2 shows the resultant changes in the Gini coefficient. Of course, the sign of the impact is the same as in the previous analysis. In addition, as the R10 increase is greater than a 1 percent increase for all of the sources, the percentage change in the Gini coefficient is greater for all sources than it was in the previous analysis. However, as a R10 increase in average income is a substantial percentage increase for the smaller income sources but not for the more dominant sources, this approach now has a bias in favour of the smaller income sources. In line with this, these sources are seen to have a greatly boosted relative impact on the Gini coefficient. In fact, wage income which dominated the previous analysis now has the second smallest impact on the Gini coefficient and remittances now replaces it as the largest influence.

This second approach has a strong intuitive appeal in that the comparative changes in the Gini coefficient could be seen to offer a simulation of the distributional consequences of a policy in which an average tax of R10 was imposed on wage income, or any other factor source, and then used by the state to finance a R10 increase in mean transfers or a tax concession to other income sources. In terms of the figures in Table 2, a R10 tax on mean wage income would decrease inequality by 0.208 percent. If this income were then spent on raising the mean of state transfers by R10, a further 0.729 percent improvement in the Gini coefficient would occur. Thus, the resultant distributional impact of such a redistribution through the fiscus would be a 0.937 percent improvement in the Gini coefficient.

However, a negative feature of such analysis arises. Owing to the fact that a R10 change implies different percentage changes to the income sources, the net change in the Gini coefficient from an across the board increase of R10 in all sources is not zero. In addition, the underlying mathematics is based on incremental (1 percent) changes. It is not clear that the impact of a R10 (14.0 percent) increase in remittance income would be accurately ascertained by simple extrapolation from the 1 percent analysis yet this is exactly what is being assumed here. The monetary simulations are derived simply by multiplying the sensitivity of the Gini coefficient to a 1 percent change in a source by the actual percentage change embodied in a fixed monetary change to the average income level of that source. Given these limitations, we have restricted ourselves to percentage changes rather than fixed monetary changes in the rest of the paper.

In lieu of the monetary change analysis, we now examine how welfare responds to changes in income from component j. An increase in source j income affects overall welfare via two routes. Firstly, it raises average income which generally has a positive effect on welfare, and secondly, it alters income distribution within the sample (as measured by the Gini coefficient) which has a positive or negative effect on welfare depending on whether income

---

Note that by "average wage income" we mean the average household income from wages, including those households who receive no such income. Thus a R10 tax on average mean income will raise revenue of R10 * number of households. This is then used to finance a transfer of an average of R10 to each household.
inequality has lessened or increased. Not surprisingly then, in examining such welfare responses, the distributional response, $\partial G / \partial \sigma_j$, only tells half of the story.

To capture both aspects of welfare, Stark et al. make use of Sen’s social welfare function for the group of the form:

$$ W = \mu (1 - G) $$

where $\mu$ and $G$, as defined previously, are the mean household income of the sample and the Gini measure of total income inequality respectively. Clearly the welfare weightings implicit in this specification are arbitrary. However, the framework is still useful in integrating average and distributional consequences resulting from changes in income sources.

Assuming, as before, that there is an exogenous increase in income from source $j$ by factor $\sigma_j$, then the sign of the change in welfare (as measured by equation (10)) can be evaluated by taking the derivative of $W$ with respect to $\sigma_j$. It can be shown (see Appendix) that the following relation holds:

$$ \frac{\partial W}{\partial \sigma_j} = \mu_j (1 - R_j G_j) $$

A closer look at equation (12) reveals that $\partial W / \partial \sigma_j$ is composed of two welfare effects:

(a) A positive mean income effect; and
(b) A distribution effect, the sign of which depends on the sign of the Gini correlation of income from component $j$ with total income ($R_j$).

If $R_j$ is negative, the distribution effect from an exogenous increase in component $j$ reinforces the positive mean income effect (i.e. both effects act to increase welfare). If $R_j$ is positive, the distribution effect acts in the opposite direction to the mean income effect. However, since both $R_j$ and $G_j$ can never exceed one, the distributional effect can never outweigh the mean income effect. Thus, even if $R_j$ is positive, an increase in income from component $j$ unambiguously increases total welfare (Stark et al., 1986: 270).

Dividing equation (12) through by $W$ it can be shown that:

$$ \left( \frac{\partial W}{\partial \sigma_j} \right) \left( \frac{1}{W} \right) = S_j \frac{1 - R_j G_j}{1 - G} $$

This expression gives a measure of the marginal percentage change in welfare (as measured by the Sen welfare index) resulting from an exogenous small percentage change in income component $j$. Like $\partial W / \partial \sigma_j$, and for the same reasons, this measure is always positive.

Table 3 shows the effect of a 1 percent increase in a particular income component on the Sen welfare index. For example, a 1 percent increase in wage income will increase the Sen index by .55 percent. A similar increase in remittances will increase the index by .13 percent.
Table 3. Effects of a 1 Percent Increase in a Component on the Sen Welfare Index: African Households

<table>
<thead>
<tr>
<th>Income source</th>
<th>Percent change in Sen index per 1 percent change in income source</th>
<th>Income effect</th>
<th>Distribution effect</th>
</tr>
</thead>
<tbody>
<tr>
<td>Remittances</td>
<td>0.133</td>
<td>0.136</td>
<td>-0.002</td>
</tr>
<tr>
<td>Wage income</td>
<td>0.549</td>
<td>1.311</td>
<td>-0.762</td>
</tr>
<tr>
<td>Capital income</td>
<td>0.059</td>
<td>0.110</td>
<td>-0.050</td>
</tr>
<tr>
<td>State transfers</td>
<td>0.180</td>
<td>0.206</td>
<td>-0.026</td>
</tr>
<tr>
<td>Agriculture</td>
<td>0.028</td>
<td>0.040</td>
<td>-0.013</td>
</tr>
<tr>
<td>Self employment</td>
<td>0.050</td>
<td>0.121</td>
<td>-0.071</td>
</tr>
</tbody>
</table>

The magnitude of the change in the index is related to the share in total income of a particular component, since the income effect of a component is in fact equal to its share in total income divided by (1-G).

We immediately notice that, although all components affect the welfare index positively, the income and distribution effects tend to act counteractively. The .55 percent increase in the index resulting from a 1 percent increase in wages comprises a large positive income effect and a large negative distribution effect. In contrast, in the case of remittances there is a significant income but negligible negative distribution effect.

Following a suggestion by Stark et al. (1986: 278), the welfare analysis can be extended by reflecting on a more general form of the social welfare function:

\[ W = \mu (1 - \alpha G) \]  

where \( \alpha \) is a 'behavioural parameter' representing the welfare weighting of equity in the distribution of income versus mean income. Clearly, our welfare analysis has so far assumed that \( \alpha \) equals one. Given that any choice of \( \alpha \) is arbitrary, it is important to explore how sensitive a welfare discussion is to the particular \( \alpha \) that is being used. Thus, our welfare discussion in the next section will explore the welfare sensitivity of a grid of alphas. To this end, the appendix contains \( \alpha \)-inclusive forms of equations 12 and 13.
III. Applying the Analysis to Rural Communities in Former Homeland Areas

The unfolding of South Africa's negotiated political settlement made it painfully clear that, even if the homeland policy writ large was appropriately regarded as coercive, top-down and artificial, there was still a dire need for and shortage of detailed analyses of homeland political dynamics. In like fashion, the move towards homeland reincorporation, the framing of new regional and rural policies and the specifics of implementing social projects within the ambit of the Reconstruction and Development Programme have led to a demand for more nuanced analyses of the processes of economic survival in the homelands. To a very limited degree, a supply of such analyses has begun to trickle forth [Donaldson, Segar and Southall (1992), Pickles and Woods (1992) and Data Research Africa (1994)]. In this section of the paper we apply the Gini decomposition analysis to rural homeland incomes, as a contribution to this corpus and as a more specific example of the use of our decomposition analysis for policy analysis.

The relative contributions of remittances, income from wage employment (henceforth wage income), state welfare incomes and agriculture are at the heart of the debate about policy towards rural homeland communities. The lingering policy stereotype of rural homeland communities is that they are singularly dependent on long range migrant labour and state pensions. A comparison of Tables 1 and 4 reveals that it is true that remittances and transfer payments make a larger contribution and wage income a smaller contribution to both average income and the distribution of income in these rural homeland communities relative to the total African population. However, if the rural homeland situation is assessed on its own rather than relative to a national benchmark, the high share of wage income in total income (52.0 percent) and the even higher share of this wage income in rural inequality (72.6 percent), along with the relatively low share of remittances in total income (13.5 percent) and inequality (3.6 percent), immediately provide a strong antidote to the prevailing policy stereotype. The importance of state welfare income as a source of average income (17.5 percent) is underlined but, like remittances, its contribution to inequality (7.8 percent) is significantly lower.

The dominance of wage income in undergirding income inequality arises both due to its importance as a share of total income and due to the fact that the distribution of wage income is highly unequal (G = .791). On the other hand, the fact that remittances and welfare incomes contribute less than their average shares to total inequality is due to two factors. First, there is the fact that income from these sources is more evenly distributed than wage income (G = .749 and .716 respectively). Second, the Gini correlations tell us that the distribution of these specific sources of income are not closely correlated with the distribution of total incomes (R = .180 and .315 respectively). Those households with high remittance income are often not the same households as those with high wage income. However, at the same time, only a negative

---

* However, as we show later, this is not to say that remittances are now unimportant.

11
Table 4. Decomposition of Rural Homeland African Income

<table>
<thead>
<tr>
<th>Income source</th>
<th>Proportion of households receiving income source ($P_a$)</th>
<th>Share in total income ($S_a$)</th>
<th>Gini for income source for households receiving such income ($G_a$)</th>
<th>Gini correlation with total income rankings ($R_a$)</th>
<th>Contribution to Gini coefficient of total income ($S_aG_aR_a$)</th>
<th>Percentage share in overall Gini</th>
</tr>
</thead>
<tbody>
<tr>
<td>Remittances</td>
<td>0.473</td>
<td>0.135</td>
<td>0.469</td>
<td>0.749</td>
<td>0.180</td>
<td>0.018</td>
</tr>
<tr>
<td>Wage income</td>
<td>0.402</td>
<td>0.520</td>
<td>0.482</td>
<td>0.791</td>
<td>0.897</td>
<td>0.369</td>
</tr>
<tr>
<td>Capital income</td>
<td>0.877</td>
<td>0.067</td>
<td>0.712</td>
<td>0.747</td>
<td>0.586</td>
<td>0.029</td>
</tr>
<tr>
<td>State transfers</td>
<td>0.374</td>
<td>0.175</td>
<td>0.241</td>
<td>0.716</td>
<td>0.315</td>
<td>0.039</td>
</tr>
<tr>
<td>Agriculture</td>
<td>0.436</td>
<td>0.047</td>
<td>0.720</td>
<td>0.878</td>
<td>0.486</td>
<td>0.020</td>
</tr>
<tr>
<td>Self-employment</td>
<td>0.127</td>
<td>0.058</td>
<td>0.625</td>
<td>0.952</td>
<td>0.591</td>
<td>0.033</td>
</tr>
<tr>
<td>Total</td>
<td>0.999</td>
<td>1.000</td>
<td>0.506</td>
<td>0.508</td>
<td>1.000</td>
<td>0.508</td>
</tr>
</tbody>
</table>

correlation would have supported the stronger conclusion that dependence on migrant remittances is one of the defining characteristics of poorer households.

Some vexing policy dilemmas begin to emerge when the sensitivity of the overall Gini to small changes in the income sources is examined. Table 4 shows that, holding all other sources of income constant, a 1 percent increase in wage income leads to a .206 percent worsening in the Gini whereas the same ceteris paribus percentage increase in remittance income and welfare payments will improve the Gini by .099 percent and .097 percent respectively.

It is precisely this potential ambiguity between the effect of different income sources on average incomes and on the distribution of income that is captured by the Sen welfare index. A 1 percent increase in wage income raises average income by .520 percent. Table 5 shows that this causes a 1.055 percent increase in welfare due to an income effect but, because of the worsening of the distribution of income, this welfare increase is offset by a distribution effect of -.749 percent. The resultant net effect is a .307 percent increase in the welfare index. The net welfare effect of a 1 percent change in remittances is almost as high (.237 percent) because, in this case, the small income effect (.274 percent) is offset by a very small negative distributional effect of -.037 percent. The net welfare effect of a 1 percent change in state welfare expenses is high (.275 percent) because it has a strong income effect (.355 percent) and a smaller, negative distributional effect (-.080 percent).
Table 5. Effects of a 1 Percent Increase in an Income Component on Income Inequality: Rural Homeland African Households

<table>
<thead>
<tr>
<th>Income source</th>
<th>Percent change in Gini coefficient</th>
<th>Percent change in Sen index</th>
<th>Income effect</th>
<th>Distribution effect</th>
<th>Mean income (Rand)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Remittances</td>
<td>-0.099</td>
<td>0.237</td>
<td>0.274</td>
<td>-0.037</td>
<td>115.36</td>
</tr>
<tr>
<td>Wage income</td>
<td>+0.206</td>
<td>0.307</td>
<td>1.055</td>
<td>-0.749</td>
<td>444.94</td>
</tr>
<tr>
<td>Capital income</td>
<td>-0.009</td>
<td>0.076</td>
<td>0.135</td>
<td>-0.059</td>
<td>57.05</td>
</tr>
<tr>
<td>State transfers</td>
<td>-0.097</td>
<td>0.275</td>
<td>0.355</td>
<td>-0.080</td>
<td>149.79</td>
</tr>
<tr>
<td>Agriculture</td>
<td>-0.007</td>
<td>0.054</td>
<td>0.095</td>
<td>-0.040</td>
<td>39.86</td>
</tr>
<tr>
<td>Self employment</td>
<td>+0.006</td>
<td>0.051</td>
<td>0.117</td>
<td>-0.066</td>
<td>49.46</td>
</tr>
</tbody>
</table>

To the extent that development implies growth and redistribution, the implication of this analysis is that welfare payments from the state and remittances are more important to rural homeland communities than their average contributions seem to imply whereas wage incomes are less important. As policy makers weight distributional considerations more highly, so this reversal will become stronger. Table 6 illustrates this by indicating the sensitivity of the Sen index to changes in the value of alpha. The values indicate the percentage by which the Sen index changes for a 1 percent increase in a particular income component.

For $\alpha = 0$, welfare is measured solely in terms of mean income. The effect of the distribution of income on welfare becomes more significant as $\alpha$ increases. $\alpha = 1$ represents the "standard" Sen index as discussed above. At $\alpha = \infty$, welfare is measured by $-\mu G$. It should be noted that this is not a meaningful measure of welfare. If all components of income were to increase by 1 percent the Gini would be unaffected: however mean income would increase by 1 percent, consequently our measure of welfare would decrease - clearly a nonsense result. $\alpha = \infty$ is included, since the values indicated in the table are the limits to which the statistics tend. $\alpha = 2$ is included to elucidate trends.

At $\alpha = 0$ the effect of a 1 percent increase in an income component is given by the share of that income component in total income. At the other extreme, $\alpha = \infty$, this effect is given by the share of that income component in the overall Gini coefficient. At $\alpha = 2$ it can be seen that a 1 percent change in an income component causes a much greater change in the Sen index. This is because $\alpha$ is very close to $1/G$ and the index is therefore close to zero.

---

9 A positive percentage in the table does not, however, imply that welfare increases. This is because welfare becomes negative for values of alpha greater than the reciprocal of the Gini coefficient ($1/G = 1.97$). Thus for $\alpha = \infty$ a change in any of the components will decrease welfare because the welfare index will be negative at this value.
Table 6. Effects of a 1 Percent Increase in an Income Component on the Sen Index for Varying Values of Alpha: Rural Homeland African Households

<table>
<thead>
<tr>
<th>Income source</th>
<th>$\alpha = 0$</th>
<th>$\alpha = 1$</th>
<th>$\alpha = 2$</th>
<th>$\alpha = \infty$</th>
</tr>
</thead>
<tbody>
<tr>
<td>Remittances</td>
<td>0.135</td>
<td>0.237</td>
<td>-6.365</td>
<td>0.037</td>
</tr>
<tr>
<td>Wage income</td>
<td>0.520</td>
<td>0.307</td>
<td>14.089</td>
<td>0.749</td>
</tr>
<tr>
<td>Capital income</td>
<td>0.067</td>
<td>0.076</td>
<td>-0.536</td>
<td>0.059</td>
</tr>
<tr>
<td>State transfers</td>
<td>0.175</td>
<td>0.275</td>
<td>-6.214</td>
<td>0.080</td>
</tr>
<tr>
<td>Agriculture</td>
<td>0.047</td>
<td>0.054</td>
<td>-0.444</td>
<td>0.040</td>
</tr>
<tr>
<td>Self employment</td>
<td>0.058</td>
<td>0.051</td>
<td>0.470</td>
<td>0.066</td>
</tr>
</tbody>
</table>

It is interesting to note the significance of different income components to the welfare index at different values of $\alpha$. A 1 percent change in wage income causes a 0.52 percent change for $\alpha = 0$, but only a 0.31 percent change for $\alpha = 1$. As we weight the distribution effect more heavily, wage income has a smaller effect on the welfare index. In contrast, both remittance income and state transfers become more significant as $\alpha$ increases. At $\alpha = 2$ one notices that wage income decreases welfare, but remittance and state transfer income increase welfare.

Much of the debate about whether rural homeland communities should be regarded as effectively proletarianized or not has revolved around the role of agriculture within these communities. Recognizing the problems associated with measuring full agricultural income using surveys, it is quite possible that the survey data understate agriculture's contribution. Taking the data at face value, agriculture's contribution to total income is small (4.7 percent) as is its contribution to income inequality (3.9 percent). Moreover, the Gini coefficient and the Sen welfare index are not very sensitive to a 1 percent change in agricultural incomes (.007 percent improvement in G and a .054 percent improvement in W). With a Gini correlation (R) of .486, there is no evidence that agricultural incomes are more important to the poorer segments of rural communities or that higher agricultural incomes are tightly aligned with higher non-agricultural incomes. Thus, our decomposition analysis of agricultural income appears to reinforce positions regarding the unimportance of agriculture rather than yielding any insights for those working on agricultural policy.

There is increasing recognition of the presence of significant income stratification and broader processes of social differentiation within rural homeland communities. One implication of this corpus for the above analysis would be to caution that the lumping together of all rural homeland households into a single group might produce an average picture that is

---

10 See Neocosmos (1993) for a recent review of these debates.

11 See Data Research Africa (1994) and Neocosmos (1993) for examples.
<table>
<thead>
<tr>
<th>Income source</th>
<th>Proportion of households receiving income from source (P)</th>
<th>Share in total household income (S)</th>
<th>Gini for income source for households receiving such income (G)</th>
<th>Gini coefficient of income source with total income rankings (R)</th>
<th>Contribution to Gini coefficient of total income (S,G,R)</th>
<th>Percentage share in Gini of total income</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Below HSL</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Remittances</td>
<td>0.539</td>
<td>0.256</td>
<td>0.436</td>
<td>0.695</td>
<td>0.306</td>
<td>0.055</td>
</tr>
<tr>
<td>Wage income</td>
<td>0.244</td>
<td>0.229</td>
<td>0.378</td>
<td>0.847</td>
<td>0.650</td>
<td>0.126</td>
</tr>
<tr>
<td>Capital income</td>
<td>0.906</td>
<td>0.077</td>
<td>0.626</td>
<td>0.661</td>
<td>0.395</td>
<td>0.020</td>
</tr>
<tr>
<td>State transfers</td>
<td>0.358</td>
<td>0.324</td>
<td>0.204</td>
<td>0.715</td>
<td>0.602</td>
<td>0.139</td>
</tr>
<tr>
<td>Agriculture</td>
<td>0.472</td>
<td>0.067</td>
<td>0.612</td>
<td>0.817</td>
<td>0.425</td>
<td>0.023</td>
</tr>
<tr>
<td>Self-employment</td>
<td>0.110</td>
<td>0.047</td>
<td>0.509</td>
<td>0.945</td>
<td>0.315</td>
<td>0.014</td>
</tr>
<tr>
<td>Total</td>
<td>0.997</td>
<td>1.000</td>
<td>0.376</td>
<td>0.377</td>
<td>1.000</td>
<td>0.377</td>
</tr>
<tr>
<td><strong>Above HSL</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Remittances</td>
<td>0.377</td>
<td>0.088</td>
<td>0.455</td>
<td>0.794</td>
<td>-0.022</td>
<td>-0.002</td>
</tr>
<tr>
<td>Wage income</td>
<td>0.630</td>
<td>0.631</td>
<td>0.389</td>
<td>0.614</td>
<td>0.859</td>
<td>0.333</td>
</tr>
<tr>
<td>Capital income</td>
<td>0.836</td>
<td>0.063</td>
<td>0.699</td>
<td>0.748</td>
<td>0.489</td>
<td>0.023</td>
</tr>
<tr>
<td>State transfers</td>
<td>0.398</td>
<td>0.118</td>
<td>0.273</td>
<td>0.710</td>
<td>-0.023</td>
<td>-0.002</td>
</tr>
<tr>
<td>Agriculture</td>
<td>0.384</td>
<td>0.039</td>
<td>0.776</td>
<td>0.913</td>
<td>0.498</td>
<td>0.018</td>
</tr>
<tr>
<td>Self-employment</td>
<td>0.150</td>
<td>0.062</td>
<td>0.583</td>
<td>0.937</td>
<td>0.500</td>
<td>0.029</td>
</tr>
<tr>
<td>Total</td>
<td>1.000</td>
<td>1.000</td>
<td>0.399</td>
<td>1.000</td>
<td>0.399</td>
<td>0.399</td>
</tr>
</tbody>
</table>

It is clear from Table 7 that there are indeed significant differences between the groups in terms of shares of total income. State welfare income (32.4 percent relative to 11.8

---

12 The Institute for Planning Research publishes poverty lines for rural and urban households of specified age composition. Following Deaton (1994), these lines were converted to an adult equivalence scale of the form: \( E = (A + 0.5K)^{0.5} \), where \( E \) = number of adult equivalents, \( A \) = number of adults, and \( K \) = number of children.

13 To facilitate discussion we will speak of the above group and the below group.
Table 8. Effects of a 1 Percent Increase in an Income Component on Economic Welfare

<table>
<thead>
<tr>
<th>Income source</th>
<th>Percent change in Gini coefficient</th>
<th>Percent change in Sen index</th>
<th>Income effect</th>
<th>Distribution effect</th>
<th>Mean income</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Below HSL</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Remittances</td>
<td>-0.112</td>
<td>0.325</td>
<td>0.412</td>
<td>-0.088</td>
<td>102.96</td>
</tr>
<tr>
<td>Wage income</td>
<td>0.105</td>
<td>0.165</td>
<td>0.368</td>
<td>-0.202</td>
<td>91.90</td>
</tr>
<tr>
<td>Capital income</td>
<td>-0.024</td>
<td>0.091</td>
<td>0.124</td>
<td>-0.032</td>
<td>30.96</td>
</tr>
<tr>
<td>State transfers</td>
<td>0.045</td>
<td>0.296</td>
<td>0.520</td>
<td>-0.224</td>
<td>130.10</td>
</tr>
<tr>
<td>Agriculture</td>
<td>-0.005</td>
<td>0.070</td>
<td>0.108</td>
<td>-0.037</td>
<td>26.90</td>
</tr>
<tr>
<td>Self employment</td>
<td>-0.010</td>
<td>0.520</td>
<td>0.075</td>
<td>-0.022</td>
<td>18.79</td>
</tr>
<tr>
<td><strong>Above HSL</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Remittances</td>
<td>-0.092</td>
<td>0.149</td>
<td>0.146</td>
<td>0.003</td>
<td>133.27</td>
</tr>
<tr>
<td>Wage income</td>
<td>0.203</td>
<td>0.496</td>
<td>1.049</td>
<td>-0.553</td>
<td>954.84</td>
</tr>
<tr>
<td>Capital income</td>
<td>-0.005</td>
<td>0.066</td>
<td>0.104</td>
<td>-0.038</td>
<td>94.73</td>
</tr>
<tr>
<td>State transfers</td>
<td>-0.122</td>
<td>0.199</td>
<td>0.196</td>
<td>0.003</td>
<td>178.22</td>
</tr>
<tr>
<td>Agriculture</td>
<td>0.005</td>
<td>0.035</td>
<td>0.064</td>
<td>-0.029</td>
<td>58.58</td>
</tr>
<tr>
<td>Self employment</td>
<td>0.012</td>
<td>0.055</td>
<td>0.103</td>
<td>-0.048</td>
<td>93.77</td>
</tr>
</tbody>
</table>

percent) and remittances (25.6 percent relative to 8.8 percent) are much more important to the below group than the above. On the other hand the share of wage income is only 22.9 percent for the below group relative to 63.1 percent for the above. All of this accords with a priori expectations.

In decomposing inequality (as measured by the Gini coefficient) it can be seen that, in both groups, wage income is more important as a share of inequality (33.4 percent and 83.4 percent respectively) than as a share of income. In the below group this is due both to the very high inequality of wage income within the group (G = .847) and the high correlation (R = .650) between those with higher incomes and those with higher wage income. For the above group, wage income is less unequally distributed (G = .614) but its dominance as a source of income leads to a high correlation with total income (R = .859) and therefore to a dominance of inequality. Consistent with this picture is the fact that for both groups inequality is very sensitive to a 1 percent increase in wage income. Such an increase worsens inequality by .105 percent for the below group and by .203 percent for the above group. This worsening of the income distribution then acts as an offsetting distributional factor in the welfare analysis (that is presented in Table 8). Thus, for the below group, the welfare effect of a 1 percent increase
in wage income is reduced to .165 which is below the welfare impact of both the remittances and state welfare income. In the case of the above group, for each percentage increase in wage income, the negative distributional effect singlehandedly reduces welfare by -.553 percent. However, the large income effect of 1.049 percent still results in a large total welfare increase of (.496 percent).

For both below and above groups the dampened role of remittances in equality is due to the low correlation (R = .306 and -.022 respectively) of the distribution of remittance income with the distribution of total income. In the case of the above group the negative correlation is very small but hints at the fact that households at the bottom of this distribution are the higher remittance households. If there had been a strong positive correlation in the below group, this would have confirmed that remittances were playing an important role in the survival of a lower-middle income group of rural households. However, the correlation for the below group is not strong (R = .306). Thus, these two correlations taken together imply a more complex role for remittance income that changes depending on where a household is in the distribution of income. This makes it very difficult to target policy at poorer rural households through remittance income.

The low correlation of remittance income in the below group explains why remittances are a 25.6 percent share of total income but only a 14.5 percent share of the overall Gini coefficient. This, together with the fact that a 1 percent increase in remittances leads to a large (.112 percent) improvement in inequality, explains the small distributional effect of -.088 percent in the welfare analysis which, in turn, complements a strong income effect of .412 percent to make the total welfare impact of remittances .325 percent. This is the largest percentage increase in welfare for any of the income sources for the lower group.

The most noticeable aspect of state welfare income is that, for the below group, it has a share of inequality (36.9 percent) that is proportionally larger than its share of income. This is due to the highly unequal distribution of state welfare incomes (G = .715). However, the above group behaves differently. State transfers form a negative percentage (-0.5 percent) of the overall Gini. A 1 percent increase in state welfare income decreases inequality by .123 percent in the above group but raises inequality by .045 percent in the below group. Such a result would seem to be consistent with a situation in which those households deriving a lot of their income from the state are to be found in the mid and upper ranges of the below group and in the lower ranges of the above group. At the end of the day, the welfare impact from a 1 percent change in these state funds is large for both groups (.296 percent and .199 percent respectively). For the below group, this is due to a very large income effect (.520 percent) outweighing a negative distribution effect (-.224 percent) whereas for the above group this is due to complementary income (.196 percent) and distribution (.003 percent) effects.

The relative unimportance of agriculture in both above and below groups as a share of income, as a share of inequality and as a contributor to increased welfare only serves to generalize the picture that emerged from the composite rural homeland analysis above implying
a low general contribution from agriculture. It seems that it will take major structural changes to the environment within which agriculture takes place before this changes.

Over the medium term, policy changes affecting remittances and state welfare income seem to be crucial to the lot of those rural homeland households who are below the Household Subsistence Level. Those above this poverty line are much more sensitive to factors that will affect their wage income and their access to state welfare payments. Given the huge demands on the state it is indeed sobering to realize how important state welfare income is in these communities.
IV. Concluding Comments

Understanding the key sources of inequality in South Africa is important in its own right and our decomposition analysis has thrown new light on the processes generating this inequality. The paper has also attempted to show, through the South African case, that the decomposition analysis provides a framework for generating useful information for development policy. The mathematics undergirding the decomposition of the Gini coefficient forces a simultaneous assessment of the average importance of income sources, the inequality within income sources and the relationship between sources. As such, it is useful in coming to grips with some of the key processes driving livelihoods.

The decomposition analysis revealed that wage income is both the most important income component and also the most important source of inequality for South Africa's African population. At the national level this is not surprising, but useful, in that it places the focus squarely on the labour market as the dominant force behind changes in South African inequality. However, the finding that this is also true for rural households in the former rural homeland areas is surprising in that it chaffs against prevailing policy wisdoms. These wisdoms either justify urban bias by linking the welfare of rural communities to urban development initiatives through the umbilical cord of migrant labour or oppose urban bias by calling attention to badly mauled but still present agricultural processes in these rural areas. There is virtually no discussion of rural labour markets and rural wage labour in either of these conventional policy wisdoms.

Our analysis clearly shows that spontaneous or policy-induced changes to wage income will have community-wide impacts in these rural areas. Rural labour markets are therefore revealed to be an area urgently in need of detailed research. This is particularly the case given that a new national public works programme and many other rural development initiatives are just beginning.

These stark contrasts with prevailing stereotypes, are revealed by the average and distributional shares attributed to income components by the decomposition analysis. The paper also illustrates the use of a welfare function to combine the average and distributional effects of changes in any income source into a net welfare effect. An increase in an income source will always increase average income but, if it also improves the distribution of income, it will have an even larger net welfare effect. Such a framework has the desirable property of increasing the welfare importance of sources of income that are important to the poorer sections of a community.

The correlation between a specific income component and total income is shown to provide a very useful indication of the situation of households who derive income from that source relative to other sources of income. So, for example, a strong negative correlation would reveal that a source is much more important to those households at the bottom of the total income distribution than to those at the top. This correlation is therefore a useful part of any targeting programme. The paper also sub-divided the rural sample using a poverty line to test
the robustness of the rural decomposition. Such sensitivity analysis is also seen to be a useful aid for targeting.

Of course, it is also important to be clear about the limitations that are imposed on policy conclusions by the mathematics of decomposition. For example, in terms of the mathematics underlying this analysis, a 1 percent increase in income from any source only goes to those that are deriving income from that source to begin with. Thus, the negative distributional consequences of a small increase in wage income for rural African communities that is shown in the above analysis should not be taken to imply that a successfully targeted public works programme which opens up new wage earning opportunities for the unemployed poor will not improve average rural incomes and the distribution of income. On the other hand, given that almost all rural African households have at least one unemployed member, a simple targeting of the unemployed - rather than the unemployed from the poorest households - might well impact on rural communities in the way suggested by the above decomposition analysis.
Appendix

"Decomposing" the Gini coefficient

Assume that within the chosen sample there are n households deriving income from K different sources (i.e. K different income components). Let \( y_i \) denote the total income of household \( i \), where \( i = 1, \ldots, n \) and \( y_k \) the income of household \( i \) from source \( k \), where \( k = 1, \ldots, K \) (thus \( y_i = \sum_{k=1}^{K} y_{ik} \)). Also, let the distribution of total household income be represented by \( Y=(y_1, \ldots, y_n) \) and the distribution of income component \( k \) be represented by \( Y_k=(y_{1k}, \ldots, y_{nk}) \).

Using this notation, the Gini coefficient \( G \) for the distribution of total income within the group can be defined as:

\[
G = \frac{2 \text{cov}(Y, F(Y))}{\mu}
\]

where \( \mu \) denotes the mean household income of the sample and \( F(Y) \) the "cumulative distribution" of total household income in the sample (i.e. \( F(Y) = (f(y_1), \ldots, f(y_n)) \) where \( f(y_i) \) is equal to the rank of \( y_i \) divided by the number of observations (n)) .

Equation (1) can be rewritten and expanded into an expression for the Gini coefficient that captures the "contribution to inequality" of each of the K components of income:

\[
G = 2 \frac{\text{cov}(Y, F(Y))}{\mu} \sum_{i=1}^{n} (y_i - E(y_i)) (f(y_i) - E(f(y_i)))
\]

\[
\Rightarrow G = 2 \frac{\text{cov}(Y, F(Y))}{\mu} \sum_{i=1}^{n} \sum_{k=1}^{K} (y_{ik} - E(y_{ik})) (f(y_i) - E(f(y_i)))
\]

\[
\Rightarrow G = 2 \frac{\text{cov}(Y, F(Y))}{\mu} \sum_{k=1}^{K} \text{cov}(Y_k, F(Y)) (\frac{\mu_k}{\mu})
\]

where \( \mu_k \) is the sample mean of income from source \( k \) and \( F(Y_k) \) is the cumulative rank distribution of income from source \( k \) (i.e. \( F(Y_k) = (f(y_{1k}), \ldots, f(y_{nk})) \) where \( f(y_{nk}) \) is equal to the rank of \( y_{nk} \) divided by the number of observations (n)).
Thus, the Gini coefficient can be written as:

\[ G = \sum_{k=1}^{K} R_k G_k S_k \]  

(2)

The effect of a change in income on the Gini

Assume that there is an exogenous increase in income from source j by some factor \( \sigma_j \) (i.e. \( y_i(\sigma_j) = (1 + \sigma_j) y_i \) for \( i = 1, \ldots, n \)). Thus the distribution of income from source j becomes \( Y'_j = ((1 + \sigma_j) y_{ij}, \ldots, (1 + \sigma_j) y_{in}) \). Let \( G \) be the Gini coefficient before the change in income and \( G(\sigma_j) \) the Gini coefficient after the change in income. Equation (2) gives the expression for \( G \). However, in order to derive an expression for \( G(\sigma_j) \) after a change in income from source j by factor \( (1 + \sigma_j) \) it is necessary to look at how the change affects each of \( G_k, R_k \) and \( S_k \) for \( k = 1, \ldots, K \):

(a) Since we are dealing with a \((1 + \sigma_j)\) times increase for in \( y_{ij} \), \( G_j \) does not change. Thus, \( G_k \) for all \( k = 1, \ldots, j, \ldots, K \).

(b) Assuming that the change in income from source j is small enough to leave the ranking of both total income and source j income unchanged, \( R_k \), as a function of ranks of income, will remain unchanged.

(b) Since \( S_k \) measures income component j’s share in total income, \( S_k \) for \( k = 1, \ldots, K \) will obviously change if income from source j changes. Let us call each income component’s new share in total income after the change in income component \( j \) \( S_k(\sigma_j) \).

Thus, we can write the Gini coefficient after the change in income component \( j \) as:

\[ G(\sigma_j) = \sum_{k=1}^{K} S_k(\sigma_j) R_k G_k \]

By definition, for \( k \neq j \):  
\[ S_k(\sigma_j) = \frac{\mu_k}{\sum_{k=1}^{K} \mu_k + \sigma_j \mu_j} \]

while for income component \( j \):

\[ S_j(\sigma_j) = \frac{(1 + \sigma_j) \mu_j}{\sum_{k=1}^{K} \mu_k + \sigma_j \mu_j} \]
Thus, the change in the Gini coefficient ($\Delta G$) stemming from the exogenous change in income from source $j$ can be written as:

$$\Delta G = G(\sigma_j) - G = \sum_{k=1}^{K} [S_k(\sigma_j) - S_k] R_k G_k$$

(4)

For $k\neq j$, the bracketed term in equation (4) can be rewritten as:

$$S_k(\sigma_j) - S_k = \frac{\mu_k}{\sum_{k=1}^{K} \mu_k + \sigma_j \mu_j} - \frac{\mu_k}{\sum_{k=1}^{K} \mu_k} = \frac{-\sigma_j \mu_k \mu_j}{\left[\sum_{k=1}^{K} \mu_k\right]^2}$$

which simplifies to:

$$S_k(\sigma_j) - S_k = \frac{-\sigma_j S_k S_j}{1 + \sigma_j S_j}$$

(5)

Similarly, for $k=j$ it can be shown that:

$$S_j(\sigma_j) - S_j = \frac{\sigma_j S_j - \sigma_j S_j^2}{1 + \sigma_j S_j}$$

(6)

Substituting equations (5) and (6) into (4), a more detailed expression for $\Delta G$ is obtained: that:

$$\Delta G = \sum_{k \neq j} \frac{-\sigma_j S_k S_j}{1 + \sigma_j S_j} R_k G_k + \frac{\sigma_j S_j - \sigma_j S_j^2}{1 + \sigma_j S_j} R_j G_j$$

$$\Rightarrow \Delta G = \sum_{k=1}^{K} \frac{-\sigma_j S_k S_j}{1 + \sigma_j S_j} R_k G_k + \frac{\sigma_j S_j}{1 + \sigma_j S_j} R_j G_j$$

(7)

In order to find the derivative of the Gini coefficient with respect to $\sigma_j$, it is simply necessary to take the limit of equation (7) divided by $\sigma_j$ as $\sigma_j$ tends to zero:

$$\lim_{\sigma_j \to 0} \frac{\Delta G}{\sigma_j} = -S_j \lim_{\sigma_j \to 0} \sum_{k=1}^{K} \frac{S_k}{1 + \sigma_j S_j} R_k G_k + \lim_{\sigma_j \to 0} \frac{S_j}{1 + \sigma_j S_j} R_j G_j$$

Hence, it can be shown that the derivative of the Gini coefficient with respect to a change in income source $j$ is:
\[
\frac{\partial G}{\partial \sigma_j} = -S_j \sum_{i=1}^{K} S_k R_k G_k + S_j R_j G_j = S_j (R_j G_j - G)
\]  

(8)

Response of the Sen Welfare function

The welfare function is defined as follows:

\[
W = \mu (1 - \alpha G)
\]

(10)

where \(\mu\) and \(G\), as defined previously, are the mean household income of the sample and the Gini measure of total income inequality respectively.

Assuming, as before, that there is an exogenous increase in income from source \(j\) by factor \(\sigma_j\), then the sign of the change in welfare (as measured by equation (10)) can be evaluated by taking the derivative of \(W\) with respect to \(\sigma_j\). That is:

\[
\frac{\partial W}{\partial \sigma_j} = \frac{\partial \mu}{\partial \sigma_j} (1 - \alpha G) - \mu \frac{\partial \alpha G}{\partial \sigma_j}
\]

(11a)

\[
\Rightarrow \frac{\partial W}{\partial \sigma_j} = \frac{\partial \mu}{\partial \sigma_j} (1 - \alpha G) - \alpha \mu \frac{\partial G}{\partial \sigma_j}
\]

(11b)

From the definition of \(\mu\) it can be shown that \(\delta \mu / \delta \sigma_j = \mu_j\). Substituting this result and equation (8) into equation (11), it can be shown that:

\[
\frac{\partial W}{\partial \sigma_j} = \mu_j (1 - \alpha G) - \mu \alpha \frac{\mu_j}{\mu} (R_j G_j - G)
\]

(12a)

\[
\Rightarrow \frac{\partial W}{\partial \sigma_j} = \mu_j (1 - \alpha R_j G_j)
\]

(12b)

Dividing equation (12) through by \(W\) it can be shown that:

\[
\left( \frac{\partial W}{\partial \sigma_j} \right) \left( \frac{1}{W} \right) = S_j \frac{1 - \alpha R_j G_j}{1 - \alpha G}
\]

(13)
References


LSMS Working Papers (continued)

No. 86 Glewwe and Hall, Poverty and Inequality during Unorthodox Adjustment: The Case of Peru, 1985–90
No. 88 Ravallion, Poverty Comparisons: A Guide to Concepts and Methods
No. 89 Thomas, Lavy, and Strauss, Public Policy and Anthropometric Outcomes in Côte d'Ivoire
No. 90 Ainsworth and others, Measuring the Impact of Fatal Adult Illness in Sub-Saharan Africa: An Annotated Household Questionnaire
No. 91 Glewwe and Jacoby, Estimating the Determinants of Cognitive Achievement in Low-Income Countries: The Case of Ghana
No. 92 Ainsworth, Economic Aspects of Child Fostering in Côte d'Ivoire
No. 93 Lavy, Investment in Human Capital: Schooling Supply Constraints in Rural Ghana
No. 94 Lavy and Quigley, Willingness to Pay for the Quality and Intensity of Medical Care: Low-Income Households in Ghana
No. 95 Schultz and Tansel, Measurement of Returns to Adult Health: Morbidity Effects on Wage Rates in Côte d'Ivoire and Ghana
No. 96 Louat, Grosh, and van der Gaag, Welfare Implications of Female Headship in Jamaican Households
No. 97 Coulornbe and Demery, Household Size in Côte d'Ivoire: Sampling Bias in the CILSS
No. 98 Glewwe and Jacoby, Delayed Primary School Enrollment and Childhood Malnutrition in Ghana: An Economic Analysis
No. 99 Baker and Grosh, Poverty Reduction through Geographic Targeting: How Well Does It Work?
No. 100 Datt and Ravallion, Income Gains for the Poor from Public Works Employment: Evidence from Two Indian Villages
No. 101 Kostermans, Assessing the Quality of Anthropometric Data: Background and Illustrated Guidelines for Survey Managers
No. 103 Benefo and Schultz, Determinants of Fertility and Child Mortality in Côte d'Ivoire and Ghana
No. 104 Behrman and Lavy, Children's Health and Achievement in School
No. 105 Lavy and Germain, Quality and Cost in Health Care Choice in Developing Countries
No. 106 Lavy, Strauss, Thomas, and De Vreyer, The Impact of the Quality of Health Care on Children's Nutrition and Survival in Ghana
No. 107 Hanushek and Lavy, School Quality, Achievement Bias, and Dropout Behavior in Egypt
No. 108 Feyistan and Ainsworth, Contraceptive Use and the Quality, Price, and Availability of Family Planning
No. 109 Thomas and Maluccio, Contraceptive Choice, Fertility, and Public Policy in Zimbabwe
No. 110 Ainsworth, Beegle, and Nyamete, The Impact of Female Schooling on Fertility and Contraceptive Use: A Study of Fourteen Sub-Saharan Countries
No. 111 Oliver, Contraceptive Use in Ghana: The Role of Service Availability, Quality, and Price
No. 112 Montgomery, Kouamé, and Oliver, The Tradeoff between Number of Children and Child Schooling: Evidence from Côte d'Ivoire and Ghana
No. 113 Pradhan, Sector Participation Decisions in Labor Supply Models
No. 114 Beegle, The Quality and Availability of Family Planning Services and Contraceptive Use in Tanzania
No. 115 Lavy, Spratt, and Leboucher, Changing Patterns of Illiteracy in Morocco: Assessment Methods Compared
No. 117 Glewwe and Hall, Who Is Most Vulnerable to Macroeconomic Shocks? Hypotheses Tests Using Panel Data from Peru
No. 118 Grosh and Baker, Proxy Means Tests for Targeting Social Programs: Simulations and Speculation
No. 119 Pitt, Women's Schooling, the Selectivity of Fertility, and Child Mortality in Sub-Saharan Africa
No. 120 Grosh and Glewwe, A Guide to Living Standards Measurement Study Surveys and their Data Sets
No. 121 van de Walle, Infrastructure and Poverty in Viet Nam
No. 122 Ravallion, Poverty Comparisons: A Guide to Concepts and Methods
No. 123 Li, The Demand for Medical Care: Evidence from Urban Areas in Bolivia
No. 124 Hentschel and Lanjouw, Constructing an Indicator of Consumption for the Analysis of Poverty: Principles and Illustrations with Reference to Ecuador