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DSRG Working Paper No. 9.

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The distribution of personal income among income recipients in South Africa, 1970 and 1976.

## Introduction

For more than 50 years South African scholars have been making estimates of the share of total income (variously defined) received by the race groups into which the South African population is divided. A summary of the results of this work has recently been provided by McGrath.[1] There has been very little by way of attempts to take the analysis of South African income distribution beyond this point; a major obstacle has been the lack of information about how income is distributed among Africans. In particular there exist no satisfactory estimates of Lorenz curves or Gini coefficients for the distribution of income among either income recipients or households. Adelman and Morris report a Gini coefficient of 0,58 for the distribution of income among 'population' in 1965; how unsatisfactory their estimate is can be seen from their assumption that 'all rural income (is) assumed to be distributed as in the Cape Peninsula.'[2] It is the primary aim of this paper to present a method of arriving at a Lorenz curve and Gini coefficient for the distribution of income among all South African[3] income recipients and to present the Lorenz curves and Gini coefficients for 1970 and 1976. There will also be brief discussions of the international context of the results,of the decomposition of total inequality and of the distribution of income among Africans.

One needs to make clear in an exercise of this type which income concept one is using. Here personal income (as defined in the national accounts) with two exclusions is used. Personal income consists of four components:

1. Remuneration of employees which consists of salaries and wages, employers' contributions to staff funds, payments in kind such as a food, clothing and quarters as well as employers' contributions to social security funds.'

2. Income from property by households which consists of 'interest, dividends and rent receipts (net) by households and profits of non-corporate enterprise'

3. Current transfers received from general government.

4. Transfers from the rest of the world.

Item 4 is excluded from consideration here as well as imputed rent (part of item 2). Both exclusions are on the grounds that they are not included by the sources of information on income distribution.

Method of estimating the overall distribution of income

The fundamental strategy is to build up an overall distribution of income from a series of uniracial unisectoral distributions. Given four races (Whites, Coloureds, Asians and Africans) and ten sectors (I-Agriculture, II-Mining, III-Manufacturing, IV-Electricity etc., V-Construction, VI-Commerce, VII-Transport etc., VIII-Finance, IX-Services, 0-Income Recipients not in Employment) one starts with 40 (41, in fact, as African agriculture is subdivided into subsistence and commercial) distributions. One then aggregates across sectors to arrive at 4 racial distributions which are in turn aggregated into an overall distribution. Formally, if $f_{ij}(x)$ $x>0$ are the density functions for race i and sector j and $n_{ij}$ are the numbers of recipients of race i and sector j, the racial density functions $f_i(x)$ are given by

$$f_i(x) = \sum_j \frac{n_{ij} f_{ij}(x)}{\sum_j n_{ij}}$$

and the overall density function by

$$f(x) = \frac{\sum_i \sum_j n_{ij} f_{ij}(x)}{\sum_i \sum_j n_{ij}}$$

When it comes to estimation, the fundamental assumption is that the individual $f_{ij}(x)$ have constant shape over the period under consideration (1970 to 1976). This assumption is necessitated by the fact that only one observation of each $f_{ij}(x)$ is available during the 1970s. The assumption does not imply that the density functions remain constant because specific allowance will be made for their location to change. But it does mean that all relative inequality measures are assumed constant for each race-sector element. How serious a limitation is this if we are trying to assess changes in overall inequality?

Many relative inequality measures are decomposable i.e. there exists a simple relationship between the measure for the population as a whole and the measures for a set of groups forming a mutually exclusive and collectively exhaustive partition of the whole population. One such measure is the Theil-measure of inequality where the relation

$$T = \sum_{j=1}^{k} S_j T_j + T_B$$

holds,[4] T being the Theil coefficient for the population as a whole, $S_j$ being the

share of group j in total income, $T_j$ being the Theil coefficient for group j and $T_B$ is the 'between-group' component of inequality - to calculate this, calculate the Theil measure on the assumption that everyone within a group receives that group's mean income. We are assuming that the $T_j$ are constant, eliminating one source of variation in T, but there is nothing in our method which prevents $S_j$ or $T_B$ from varying i.e. two sources out of three can contribute to variations in T.

Initial estimates of the $f_{.j}(x)$ are made as follows:

(a) Whites, Coloureds and Asians: Tabulations of the distribution of personal income by race and industry are provided in the Personal Income Report of the 1970 Population Census. They are of the standard form: $n_1$ people have incomes in the interval $(0, x_1]$ , $n_2$ in $(x_1, x_2]$ etc. A distribution function can be built up from this information to have the exact observed values 0, $F_1$, $F_2$, at 0, $x_1$, $x_2$ ... etc., while other values of F are supplied using cubic spline function interpolation. The distribution function is differentiable; differentiation yields a density function on the basis of which inequality measures can be calculated.[5]

(b) Africans: No comprehensive tabulations of the distribution of personal income are available. Tabulations with the best joint coverage appear in 10 reports of income and expenditure surveys carried out in urban areas in 1975 by the Bureau of Market Research. These cover African areas in Bloemfontein, Pretoria, Johannesburg, East London, Durban, Port Elizabeth - Uitenhage, Umtata, Pietermaritzburg, Cape Town and the East and West Rand. Multiple and single households are covered in each case save that of the East and West Rand where only multiple households are covered. In each of the 19 cases, the sample size and the size of the universe sampled are given. In addition one is given the following information:

- the number of people receiving income in each sector and the average income received
- a distribution of income in the standard form for all income receivers.

The 19 samples were amalgamated using the reciprocal of the sampling percentages as weights, multiplied by a factor to ensure the amalgamated sample size was equal to the sum of the original sample sizes. The problem then becomes that of:
(i) assessing the extent of coverage in each sector
(ii) assigning variances to sectoral distributions of income.
The information is summarized in Table 1.

Table 1 - *BMR information on the distribution of income among African income receivers, 1975.*

(a) Sectoral information

| Sector | Number in amalgamated sample | Mean income | Degree of sectoral coverage (%) |
|---|---|---|---|
| I | 5 | 1631 | - |
| II | 84 | 1259 | 3 |
| III | 1417 | 1218 | 38 |
| IV | 12 | 1715 | 11 |
| V | 410 | 1042 | 24 |
| VI | 1328 | 944 | 77 |
| VII | 399 | 1215 | 56 |
| VIII | 98 | 1072 | 39 |
| IX | 2646 | 794 | 31 |
| 0 | 360 | 265 | - |

*Note:* The degree of sectoral coverage was found by raising the amalgamated sample to the size of the universes sampled and comparing income recipients with total employment (found from other sources) in sectors II-IX. The figures therefore express how well employment in each sector is represented in the areas sampled.

(b) Distributional information

| Income class | Number |
|---|---|
| 0-249 | 370 |
| 250-499 | 691 |
| 500-749 | 1119 |
| 750-999 | 939 |
| 1000-1249 | 966 |
| 1250-1499 | 811 |
| 1500-1749 | 592 |
| 1750-1999 | 379 |
| 2000-2249 | 273 |
| 2250-2499 | 197 |
| 2500-2999 | 201 |
| 3000-3999 | 131 |
| 4000-4999 | 45 |
| 5000+ | 51 |

Sectoral coverage varies widely from fair to abysmal; the latter sectors will require estimates of variance from other sources.

We now proceed as follows. There are 13 degrees of freedom in the income distribution; we have to estimate parameters for 10 density functions. The sectoral means enable us to estimate one parameter each; the distribution enables us to estimate one other each. So we are obliged to consider the class of two parameter density functions as candidate forms for the sectoral distributions. The log-normal form has the best credentials and is therefore selected. The African density function then has the form

$$f_4(x) = \sum_j \frac{n_{4j} \; \frac{1}{\sqrt{2\pi}\,\sigma_j x} e^{-\frac{1}{2\sigma_j^2}(\ln x - \mu_j)^2}}{\sum_j n_{4j}} \quad \ldots. \qquad (1)$$

If we denote the sectoral means by $\bar{x}_j$, the relation

$$\bar{x}_j = e^{\mu_j + \frac{1}{2}\sigma_j^2} \quad \ldots.. \qquad (2)$$

also holds. This equation can be used to eliminate $\mu_j$ from equation (1). $f_4(x)$ then depends only on the $\sigma_j$. For any set of $\sigma_j$ the integrals $\int_{x_k}^{x_{k+1}} f_4(x')\,dx'$ can be calculated, the $x_k$ (k=0, 1, ..., 14) referring to the class boundaries of the overall income distribution. Denote $(\sum_j n'_{4j}) \int_{x_k}^{x_{k+1}} f_4(x')\,dx'$ by $E_k$, the expected frequencies in each class and denote the observed frequencies by $O_k$. Then, as always

$$\chi^2 = \frac{\Sigma (O_k - E_k)^2}{E_k}$$

$\chi^2$ is, of course, a function of the $\sigma_j$; the set of $\sigma_j$ minimising $\chi^2$ is selected (maximising 'goodness of fit'). A computer minimisation algorithm was used to find the set of $\sigma_j$. The $\mu_j$ are then calculated from (2) and parameter estimation is complete. In fact the $\sigma_j$ obtained by this method for sectors I (agriculture), II (mining), IV (electricity etc.) and 0 were too unreliable to be used because of inadequate coverage of these sectors in the sample.

Accordingly lognormal density functions were fitted to the Coloured sectoral distributions and their $\sigma_j$'s estimated. For the six sectors where the minimum $\chi^2$ method yielded acceptable $\sigma_j$'s it was found that these (for Africans) were on average 0,635 those for Coloureds, so this fraction was applied to the four remaining Coloured $\sigma_j$'s to get African estimates. The question remains of what to do about subsistence agriculture - here the finding that rural incomes in Botswana were roughly lognormally distributed with a Gini coefficient of 0,52 [6] was used, the South African distribution being assumed the same.

How do the locations of the $f_{ij}(x)$ change while the shapes remain constant? Associated with each original $f_{ij}(x)$ is a mean $\bar{x}^{0}_{ij}$. As time passes, the $\bar{x}_{ij}$ change. In the case of cubic spline distribution functions the way to accommodate this is as follows.

Let $k_{ij} = \frac{\bar{x}_{ij}}{\bar{x}^{0}_{ij}}$. Then let the class limits in the (i,j)-th case each be multiplied by $k_{ij}$. The values of the distribution function at the original class limits are now assumed to hold at the revised class limits. Should a cubic spline function now be fitted to the revised data, the associated density function will have the same shape (with identical relative inequality measures) with the new mean.

In the case of the lognormal density functions one simply lets $\sigma_j$ (the shape parameter) remain constant and alters $\mu_j$ (the location parameter) in accordance with equation (2) above.

It remains, then, to generate tables of $n_{ij}$ and $\bar{x}_{ij}$ for the 41 elementary distributions in 1970 and 1976. Details of how this is done are provided in Appendix I. Table 2 presents the results.

Results:

From the information in Table 2, racial shares in personal income can be calculated and are found to be as follows:

| | Whites | Coloureds | Asians | Africans |
|---|---|---|---|---|
| | | (percent) | | |
| 1970 | 71,7 | 6,2 | 2,3 | 19,8 |
| 1976 | 65,7 | 6,4 | 2,7 | 25,1 |

The 1970 figures are very close to those reported by McGrath.[7] The drop in the white share has been reported by Nattrass.[8] So our methods yield results which agree with those of other researchers in the field.

Table 2 - *Numbers of recipients and average income received by each race in each sector 1970 and 1976* ($\bar{x}_{ij}$ in Rand/year)

| | 1970 | | | | | | | | 1976 | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | Whites | | Coloureds | | Asians | | Africans | | Whites | | Coloureds | | Asians | | Africans | |
| Sector | $n_{1j}$ | $\bar{x}_{1j}$ | $n_{2j}$ | $\bar{x}_{2j}$ | $n_{3j}$ | $\bar{x}_{3j}$ | $n_{4j}$ | $\bar{x}_{4j}$ | $n_{1j}$ | $\bar{x}_{1j}$ | $n_{2j}$ | $\bar{x}_{2j}$ | $n_{3j}$ | $\bar{x}_{3j}$ | $n_{4j}$ | $\bar{x}_{4j}$ |
| IA | 100429 | 5361 | 220207 | 233 | 7810 | 1995 | 1322440 | 115 | 98161 | 12455 | 179612 | 621 | 6788 | 5174 | 988189 | 304 |
| IB | - | - | - | - | - | - | 406400 | 133 | - | - | - | - | - | - | 406400 | 292 |
| II | 75749 | 5657 | 6786 | 922 | 622 | 1183 | 599688 | 245 | 88583 | 10184 | 7371 | 2183 | 1094 | 3406 | 606984 | 1089 |
| III | 254327 | 4896 | 183062 | 974 | 64334 | 1045 | 567198 | 709 | 276900 | 9227 | 205700 | 2093 | 72900 | 2494 | 717900 | 1696 |
| IV | 7959 | 4849 | 642 | 999 | 2 | 517 | 13878 | 666 | 13000 | 8963 | 1300 | 2221 | - | - | 2300 | 1674 |
| V | 50213 | 5048 | 48718 | 1427 | 5766 | 1816 | 213117 | 658 | 60500 | 8699 | 52900 | 2844 | 5800 | 3895 | 327700 | 1471 |
| VI | 285896 | 3517 | 75498 | 954 | 43541 | 1675 | 316319 | 672 | 323925 | 6421 | 96020 | 1940 | 49487 | 3227 | 371447 | 1391 |
| VII | 161641 | 4825 | 30838 | 1088 | 5650 | 1067 | 150387 | 696 | 171189 | 9169 | 28008 | 1876 | 8885 | 2997 | 191978 | 1627 |
| VIII | 133795 | 4507 | 6808 | 1263 | 2817 | 2091 | 35264 | 887 | 158118 | 8000 | 12905 | 2755 | 9932 | 3763 | 49064 | 2123 |
| IX | 290243 | 3862 | 169264 | 705 | 23296 | 1058 | 1188512 | 441 | 351506 | 6905 | 207099 | 1469 | 28234 | 2735 | 1414846 | 1030 |
| 0 | 299549 | 1712 | 87705 | 259 | 20242 | 384 | 384427 | 58 | 316294 | 3420 | 93509 | 582 | 24095 | 862 | 373100 | 140 |
| Totals | 1659801 | | 829528 | | 174080 | | 5197630 | | 1858176 | | 884424 | | 207215 | | 5449908 | |

Once the aggregate density function is known, points on the Lorenz curve can be calculated as

$$\left( \int_0^{x_K} f(x)dx, \quad \int_0^{x_K} \frac{xf(x)dx}{\bar{x}} \right)$$

Table 3 sets out points on the Lorenz curve for 1970 and 1976.

Table 3 - *Lorenz curve points - 1970 and 1976.*

| | 1970 | | 1976 | |
|---|---|---|---|---|
| Income (x) | Proportion of people with income less than x | Proportion of income accruing to these people | Proportion of people with income less than x | Proportion of income accruing to these people |
| 100 | 0,2385 | 0,0119 | 0,0128 | 0,0005 |
| 150 | 0,2904 | 0,0176 | 0,0588 | 0,0025 |
| 200 | 0,3238 | 0,0230 | 0,1039 | 0,0063 |
| 250 | 0,3951 | 0,0374 | | |
| 300 | 0,4208 | 0,0437 | 0,2149 | 0,0179 |
| 400 | 0,5478 | 0,0840 | 0,2402 | 0,0214 |
| 500 | 0,5835 | 0,0980 | 0,2587 | 0,0249 |
| 600 | 0,6570 | 0,1349 | 0,2771 | 0,0293 |
| 700 | 0,7411 | 0,1839 | | |
| 800 | 0,7645 | 0,1993 | 0,4145 | 0,0704 |
| 1000 | 0,7892 | 0,2193 | 0,5096 | 0,1062 |
| 1200 | 0,8048 | 0,2346 | 0,5758 | 0,1369 |
| 1400 | 0,8172 | 0,2492 | 0,6341 | 0,1691 |
| 1600 | 0,8292 | 0,2654 | 0,7251 | 0,2268 |
| 2000 | 0,8511 | 0,3008 | 0,7690 | 0,2582 |
| 2500 | 0,8720 | 0,3431 | 0,7947 | 0,2832 |
| 3000 | 0,8899 | 0,3874 | 0,8139 | 0,3053 |
| 3500 | 0,9058 | 0,4338 | 0,8318 | 0,3299 |
| 4000 | 0,9187 | 0,4775 | 0,8470 | 0,3541 |
| 4500 | 0,9312 | 0,5254 | 0,8592 | 0,3759 |
| 5000 | 0,9428 | 0,5750 | 0,8691 | 0,3973 |
| 6000 | 0,9606 | 0,6625 | 0,8901 | 0,4443 |
| 7000 | 0,9725 | 0,7321 | 0,9070 | 0,4908 |
| 8000 | 0,9804 | 0,7856 | 0,9218 | 0,5376 |
| 10000 | 0,9894 | 0,8575 | 0,9475 | 0,6350 |
| 15000 | 0,9962 | 0,9286 | 0,9796 | 0,7984 |
| 20000 | 0,9981 | 0,9593 | 0,9906 | 0,8784 |
| 30000 | | | 0,9964 | 0,9358 |

| Group | | Share | |
|---|---|---|---|
| | | 1970 | 1976 |
| Bottom | 40% | 3,85% | 6,57% |
| Next | 20% | 6,71% | 8,39% |
| Next | 20% | 12,41% | 13,93% |
| Top | 20% | 77,03% | 71,11% |

These Lorenz curves are plotted on Figure 1. The Gini coefficients for 1970 and 1976 are 0,71 and 0,65 respectively. By international standards these values are extremely high - in the list of income distributions among households and persons for 56 countries presented by Paukert [9] there is no Gini coefficient as high as 0,71 (or 0,65, for that matter, though some countries come close to this latter figure). Without all the evidence being in, we may safely say that South Africa is at or near the head of the world inequality league. The decline between 1970 and 1976 is substantial, however, and we shall look at it in more detail shortly.

The overall distribution of income can be divided into quintiles and the racial composition of each quintile examined. The results of this exercise are presented below:

| Group | Percent of group | | | | | |
|---|---|---|---|---|---|---|
| | White | | Coloured/Asian | | African | |
| | 1970 | 1976 | 1970 | 1976 | 1970 | 1976 |
| Bottom 60% | 3 | 4 | 11 | 11 | 86 | 85 |
| Next 20% | 9 | 12 | 17 | 18 | 74 | 70 |
| Top 20% | 86 | 86 | 13 | 13 | 1 | 1 |

Very little has changed in the bottom three and top quintiles. In the quintile next to the top, Africans were less heavily represented in 1976 than in 1970. The difference in the racial composition between the top quintile and the other four is, of course, extreme.

If inequality is measured by a decomposable index, the relative importance of various components of inequality can be assessed. The Gini coefficient is not decomposable (or not readily so); a decomposable measure often used is the Theil coefficient whose decomposition has already been discussed. Table 4 presents elementary (race-sector) Theil coefficients, racial Theil coefficients and the overall Theil coefficient for 1970 and 1976.

Two observations are particularly worth making:

(a) The 'between-sector' contributions to the racial Theil coefficients are small in the case of Whites and Asians and, to a lesser extent, Coloureds, relative to the 'within-sector' contributions as one would expect if labour markets are in rough inter-sectoral equilibrium. The position is reversed in the case of Africans where the 'between-sector' component dominates. This suggests lack of equilibrium

Figure 1 – Lorenz Curves - Distribution of Personal Income 1970 and 1976

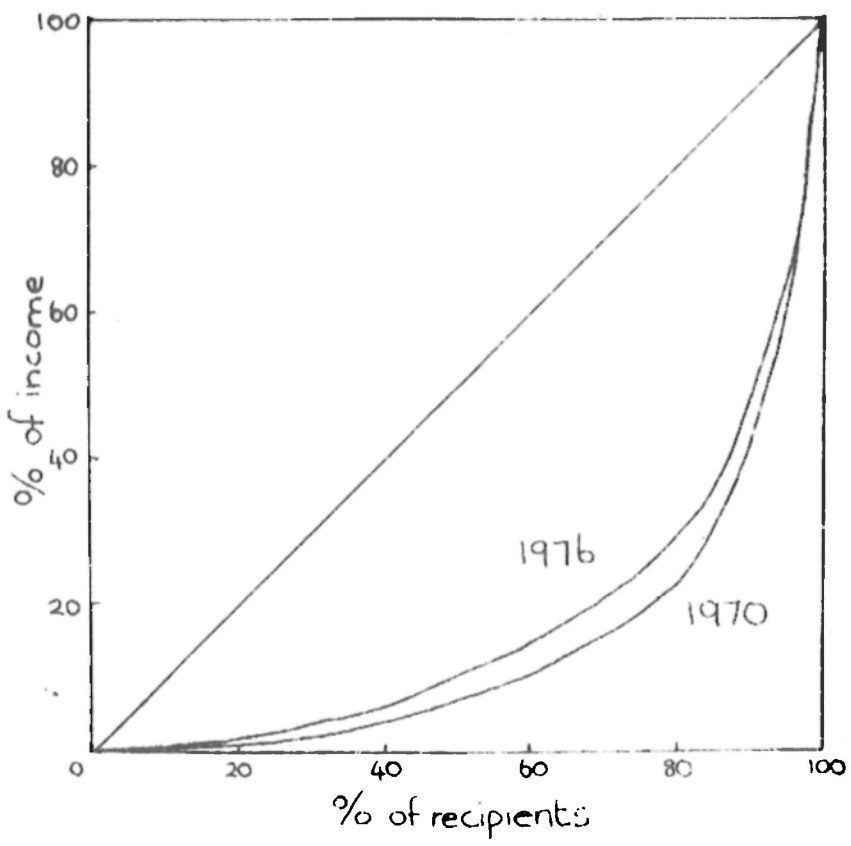


Table 4 - *Race - sector, racial and overall Theil coefficients - 1970 and 1976*

| | 1970 | | | | | | | | 1976 | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | Whites | | Coloureds | | Asians | | Africans | | Whites | | Coloureds | | Asians | | Africans | |
| Sector | $T_{1j}$ | $S_{1j}$ | $T_{2j}$ | $S_{2j}$ | $T_{3j}$ | $S_{3j}$ | $T_{4j}$ | $S_{4j}$ | $T_{1j}$ | $S_{1j}$ | $T_{2j}$ | $S_{2j}$ | $T_{3j}$ | $S_{3j}$ | $T_{4j}$ | $S_{4j}$ |
| IA | 0,529 | 0,0825 | 0,428 | 0,0913 | 0,554 | 0,0737 | 0,169 | 0,0845 | 0,529 | 0,0889 | 0,428 | 0,0830 | 0,554 | 0,0622 | 0,169 | 0,0571 |
| IB | - | - | - | - | - | - | 0,499 | 0,0300 | - | - | - | - | - | - | 0,499 | 0,0226 |
| II | 0,134 | 0,0657 | 0,441 | 0,0111 | 0,183 | 0,0035 | 0,173 | 0,0816 | 0,134 | 0,0656 | 0,441 | 0,0120 | 0,183 | 0,0066 | 0,173 | 0,1257 |
| III | 0,231 | 0,1908 | 0,223 | 0,3171 | 0,275 | 0,3182 | 0,098 | 0,2235 | 0,231 | 0,1859 | 0,223 | 0,3202 | 0,275 | 0,3218 | 0,098 | 0,2315 |
| IV | 0,129 | 0,0059 | 0,182 | 0,0011 | - | - | 0,099 | 0,0051 | 0,129 | 0,0085 | 0,182 | 0,0021 | - | - | 0,099 | 0,0073 |
| V | 0,233 | 0,0388 | 0,303 | 0,1236 | 0,236 | 0,0496 | 0,142 | 0,0779 | 0,233 | 0,0383 | 0,303 | 0,1119 | 0,236 | 0,0400 | 0,142 | 0,0916 |
| VI | 0,340 | 0,1541 | 0,308 | 0,1281 | 0,388 | 0,3452 | 0,178 | 0,1181 | 0,340 | 0,1513 | 0,308 | 0,1386 | 0,388 | 0,2827 | 0,178 | 0,0982 |
| VII | 0,185 | 0,1195 | 0,192 | 0,0597 | 0,453 | 0,0285 | 0,099 | 0,0582 | 0,185 | 0,1142 | 0,192 | 0,0391 | 0,453 | 0,0471 | 0,099 | 0,0594 |
| VIII | 0,402 | 0,0924 | 0,245 | 0,0153 | 0,378 | 0,0279 | 0,134 | 0,0174 | 0,402 | 0,0920 | 0,245 | 0,0264 | 0,378 | 0,0662 | 0,134 | 0,0198 |
| IX | 0,297 | 0,1718 | 0,593 | 0,2122 | 0,383 | 0,1167 | 0,268 | 0,2912 | 0,297 | 0,1766 | 0,593 | 0,2262 | 0,383 | 0,1367 | 0,268 | 0,2769 |
| 0 | 0,623 | 0,0786 | 0,397 | 0,0404 | 0,596 | 0,0368 | 0,160 | 0,0124 | 0,623 | 0,0787 | 0,397 | 0,0405 | 0,596 | 0,0368 | 0,160 | 0,0100 |
| $\Sigma S_{ij}T_{ij}$ | 0,318 | | 0,349 | | 0,365 | | 0,186 | | 0,320 | | 0,353 | | 0,364 | | 0,181 | |
| $T_B$ | 0,052 | | 0,166 | | 0,072 | | 0,249 | | 0,054 | | 0,114 | | 0,057 | | 0,192 | |
| $T_i$ | 0,370 | | 0,515 | | 0,437 | | 0,435 | | 0,374 | | 0,467 | | 0,421 | | 0,373 | |
| $S_i$ | 0,7173 | | 0,0618 | | 0,0232 | | 0,1977 | | 0,6572 | | 0,0643 | | 0,0270 | | 0,2515 | |

| | |
|---|---|
| $\Sigma S_i T_i$ | 0,393 |
| $T_B$ | 0,607 |
| T | 1,000 |

| | |
|---|---|
| $\Sigma S_i T_i$ | 0,381 |
| $T_B$ | 0,448 |
| T | 0,829 |

between sectors in the African labour market; for readers familiar with administrative 'labour canalisation' practices in respect of Africans this will come as no surprise.

(b) Comparing the $\sum_j S_{ij} T_{ij}$, $T_{iB}$, $\Sigma S_i T_i$ and $T_B$ terms for 1970 and 1976 we may note that there has been a reduction in Theil inequality between sectors for Coloureds, Asians and Africans over the period 1970-1976 leading to a reduction in the Theil coefficients for these races. Shares of income have also changed, and there is not much of a change in the 'within race' component of overall Theil inequality. The 'between race' component has dropped quite sharply leading to a drop in the overall Theil coefficient paralleling the drop in the Gini coefficient.

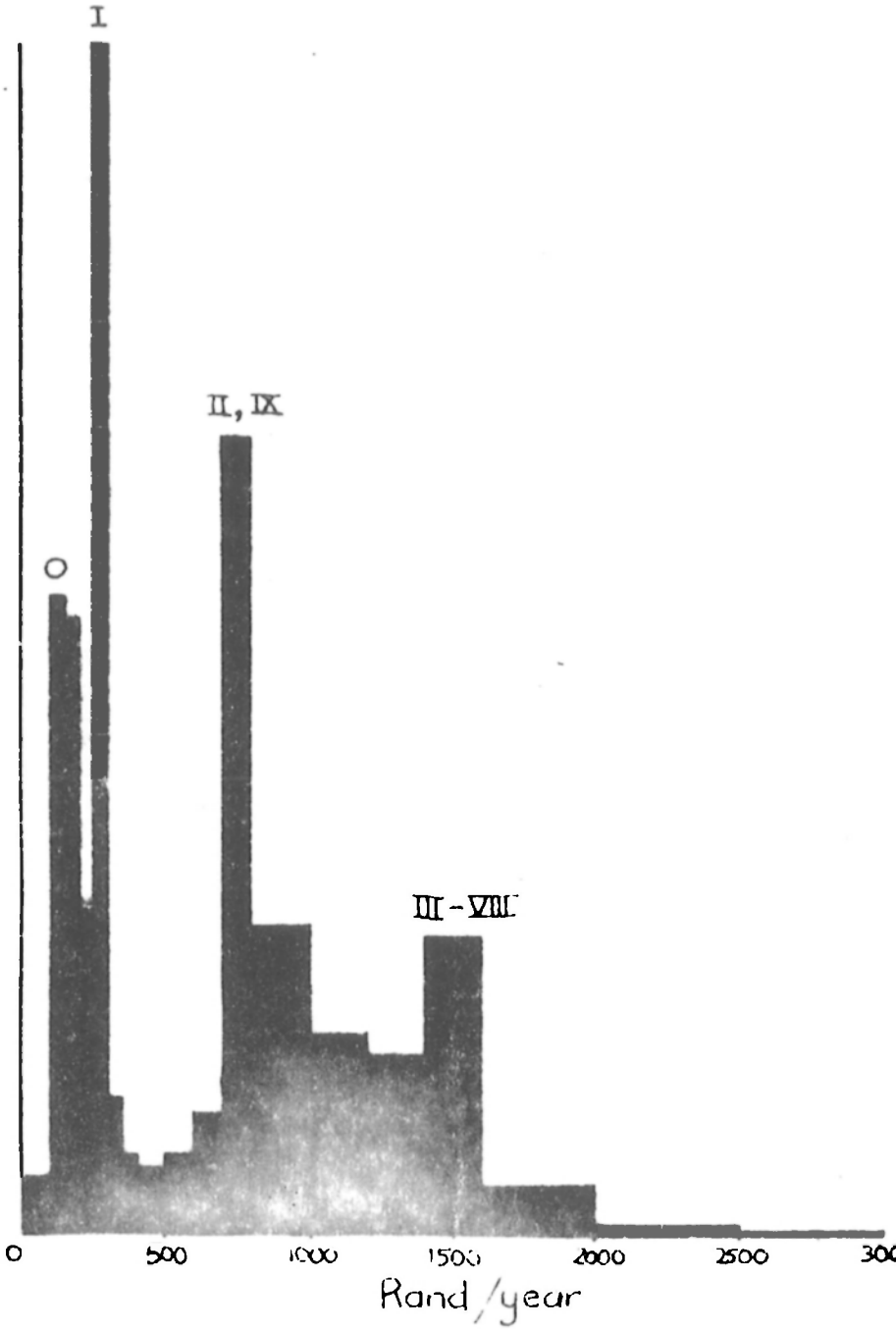
In view of the special conditions among Africans, it is worth taking a particular look at the African income distribution. A histogram for 1976 appears as Figure 2 calculated from the density function equation (1). Distributions of income most commonly are unimodal; our histogram, however, has four peaks. Next to the peaks are entered the sectors with which they are associated. The first peak is associated with transfer incomes, the next with agriculture, the third with mining and services (of which domestic service is an important part) and the last with manufacturing, electricity etc., construction, commerce, transport, etc., and finance. The separation between the peaks arises from the restriction of access to the more desirable sectors.

A glance at Figure 2 also shows how ambiguous are the currently modish 'strategies' of narrowing the wage-gap (in sector III-VIII) between whites and blacks (few whites work in agriculture, mining and domestic service and those that do - in mining - are not going to see differentials much reduced without a fight) and of improving the urban environment. These, if implemented, will move the right hand tail of the distribution further to the right and so tend to increase inequality among Africans (although between-race inequality would drop). Serious consideration of programmes to improve the situation of people in the left-hand part of the distribution would be much more to the point.

Summary of results

(a) Up to now, studies of the South African distribution of income have stopped with the calculation of racial shares of total income. By building up an overall distribution from distributions associated with each race, it is possible, however, to draw a Lorenz curve and calculate a Gini coefficient for the distribution of personal income between income recipients.

Figure 2 - Distribution of income among Africans 1976



(b) The Gini coefficient was found to be 0,71 in 1970 and 0,65 in 1976. Coefficients greater than these are not reported for any country in a quite comprehensive list published by the International Labour Organisation in 1973.

(c) While 85% of the bottom 60% of income earners were African, only 1% of the top 20% were African in 1976. 86% of the top 20% in 1976 were White.

(d) The decrease of Theil-inequality between 1970 and 1976 is mainly attributable to a decrease in inequality between races. Inequality among Coloureds, Asians and Africans also fell over the period.

(e) The African distribution of income has a peculiar 4-peaked shape reflecting the state of administratively imposed disequilibrium in the African labour market.

NOTES:

1. See M.D. McGrath, Racial Income Distribution in South Africa, Black/White Income Gap Project Interim Research Report No. 2. Department of Economics, University of Natal, Durban, 1977, especially Tables 1 and 2.

2. I. Adelman and C.T. Morris. Economic Growth and Social Equity in Developing Countries, Stanford University Press, California, 1973, p. 247.

3. Throughout this paper South Africa refers to the territory contemplated in the Act of Union, i.e. Transkei and Bophuthatswana and all other 'homelands' are included.

4. See, for instance, F.A. Cowell, Measuring Inequality, Philip Allan, Oxford, 1977, p. 166. Given a density function $f(x)$, $x>o$ the Theil coefficient is defined as $\int_o^{\infty} \frac{x}{\bar{x}} \log(\frac{x}{\bar{x}})\, f(x)\, dx$ (Cowell, p.154)

5. For a fuller discussion of the cubic spline function see my 'Income Distribution Among Settled Urban African Households in South Africa: 1970 and 1975', DSRG Working Paper no. 6, Pietermaritzburg, 1978, p.4. and Appendix I.

6. See Republic of Botswana Rural Income Survey 1974/75, Gaborone, Government Printer, 1976.

7. McGrath, op. cit., Table 6.

8. See J. Nattrass, The narrowing of Wage Differentials in South Africa, South African Journal of Economics, vol. 45 no.4, 1977, p. 431, Nattrass's income concept is 'personal income excluding income in kind' which is different from ours. It is open to question whether she has in fact measured what she purported to measure; however, a change of similar extent to ours between 1970 and 1975 shows up.

9. See F. Paukert, Income Distribution at Different Levels of Development; A Survey of Evidence, International Labour Review, vol. 108 nos. 2/3, August/September 1973, pp. 97-125.

Appendix I

Generation of Table 2 - Numbers of recipients and average income received by each race in each sector 1970 and 1976

1. Personal income as defined for the purposes of this study can be divided into two main parts:

| | | 1970 | 1976 |
|---|---|---|---|
| | | (R mill) | |
| A. | Remuneration of employees | 6990 | 16374 |
| B. | Property and transfer income | | |
| | Household property income | 2027 | 4271 |
| | Current transfers from government | 293 | 805 |
| | Less imputed rent | -208 | -533 |
| | | 2112 | 4543 |
| TOTAL | | 9102 | 20917 |

Source: RSA, South African Statistics 1978, p. 21.9 and 21.17. Note that the two estimates of remuneration of employees on these pages are unreconciled. I have used the p.21.9 estimates.

The end result of our calculations must be that $\sum_i \sum_j n_{ij} \bar{x}_{ij}$ equals these totals

2. Remuneration of employees is broken down by sector but not by race. To get the race-sector breakdown we must turn to the (incomplete) employment, salaries and wages series (S.A. Statistics 1978, pp. 7.6 and 7.7). These statistics are incomplete in two senses

- they do not cover all employment
- they do not cover all components of remuneration.

For the sectors they do cover fully they are nonetheless used as a basis for our calculations.

Procedures for each sector are detailed below:

IA. Wage employment in agriculture. Numbers and average earnings (in cash and kind) for regular and casual employers were taken from the Agricultural Censuses. 1970 figures are the means of those found in the 1969 and 1971 Censuses; 1976 figures were taken from the Statistical News Release announcing the preliminary results of the 1976 Agricultural Census. Average wages were multiplied by a factor to bring total remuneration up to the national accounts total.

IB Incomes of Whites, Coloureds and Asian farmers. Information on the numbers of White, Coloured and Asian farmers is to be found in the 1969 and 1971 Agricultural Censuses. 70% of the gross operating profit in agriculture was assumed to accrue as income to these farmers. In the absence of further information average incomes for the three races were assumed equal. The numbers of farmers of each race were assumed to be the same in 1976 as in 1970. These incomes are property incomes.

IC Subsistence agriculture. It was assumed that the average income in subsistence agriculture in 1970 was the same as that in African regular agricultural employment. The total value of subsistence production was taken from BENBO, Black Development, Pretoria, 1976 and the number of recipients found by division. For 1976 it was assumed that the number of recipients was the same as in 1970, and that the real value of subsistence production was the same in 1976 as it had been in 1973. These incomes are also property incomes.

II. Mining. Numbers of recipients and average incomes were taken from RSA, Mining Statistics, 1970 and 1976. Average incomes were multiplied by a factor to bring total remuneration up to the national accounts level.

III. Manufacturing. Numbers of recipients and average incomes were taken from S.A. Statistics 1978. Average incomes were multiplied by a factor to bring total remuneration up to the national accounts level.

IV. Electricity, etc. Numbers of recipients and average incomes were taken from S.A. Statistics 1978. As many of the employees in this sector are counted by S.A. Statistics under IXA - Government employment, total incomes under IV and IX A are amalgamated and a factor calculated which will bring the total up to the national accounts level for both sectors.

V. Construction. As III.

VIA. Commerce - Working Proprietors. The numbers of working proprietors in 1970 was taken from the 1971 Census of wholesale and retail trade. Gross operating profit (after provision for depreciation) was allocated between small and large establishments in sector VI. That accruing to small firms was treated as income for working proprietors. It was assumed that the numbers of working proprietors were the same in 1976 as in 1970. These incomes are property incomes.

VIB. Commerce - Employees. Numbers of recipients and average incomes were taken from S.A. Statistics 1978 with an adjustment to numbers made to compensate for incomplete coverage of the accommodation subsector. Average wages were multiplied by a factor to bring total remuneration up to the national accounts level.

VII.A. Transport - private sector. Numbers of employees and total remuneration were taken from the Census of Transport and Allied Workers 1970. In arriving at average racial wage rates it was assumed that these bore the same relation to one another as did their public sector counterparts. 1976 figures were found by assuming that the ratio of private to public sector employment and average earnings had remained constant since 1970.

VII.B. Transport - public sector. Numbers of employees and average incomes were taken from S.A. Statistics 1978. Average incomes in sectors VIIA and VIIB were multiplied by the same factor to bring total remuneration for transport up to the national accounts level.

VIII. Finance. As for VIB replacing 'accommodation' by 'real estate and business services.'

IXA. Government service. See IV.

IXB. Private sector services other than domestic. The 1970 employment figures were derived from the 1970 Population Census. Total remuneration (from the national accounts) was allocated so that average racial incomes bore the same relation to each other as their public sector counterparts. 1976 employment figures were found by techniques discussed in Chapter IV of 'Urban and Rural Unemployment in South Africa' in (ed) C.Simkins and C.Desmond, South African Unemployment: A Black Picture, DSRG/AIM, 1978. Average racial incomes were calculated in the same wayas for 1970.

IXC. Domestic servants.The employment figures were derived in the same way as those for sector IXB. Average racial incomes were assumed indentical.

0. Income recipients not in employment. The means from the 1970 Personal Income report (which referred to the period 1.4.69 - 30.3.70) were inflated to convert them to calendar 1970 figures. The number and average incomes for Africans was

obtained from the Social Security section of S.A. Statistics 1978. Total income in this sector was assumed to have risen in proportion to total income from property and transfers between 1970 and 1976; recipients were assumed to have risen in proportion to total income recipients. The average racial incomes were assumed to bear the same relation to each other in 1976 as in 1970. These are property and transfer incomes.

All remuneration of employees is now accounted for. Some of the property and transfer income is also accounted for (in sectors IB, IC, VIA and 0). The proportion of property and transfer income thus found is 56% in both 1970 and 1976. The remainder is assumed to accrue to Whites in sectors II-V and VIB-IXB. Average incomes in these sectors are inflated by a constant factor to reflect this.

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1. CHARLES SIMKINS AND DUNCAN CLARKE, *Structural Unemployment in Southern Africa,* Natal University Press, 1978. Price: R3,75 (Order from the Press at P.O. Box 375, Pietermaritzburg, 3200).

2. CHARLES AND COSMAS DESMOND (eds.), *South African Unemployment: A Black Picture,* Development Studies Research Group and Agency for Industrial Mission, 1978. Price:R3.

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