**THE DISTRIBUTION OF RESOURCES IN EDUCATION
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I. Introduction

Over the recent past, there have been enormous political changes in South Africa. The process of further change has now become inexorable and the limited democracy that exists in that country is likely to be considerably expanded so that the majority black population will be able to participate in government (blacks have hitherto been excluded from participating in elections at the national level). Irrespective of what government ultimately comes to power, there will be a critical appraisal of existing social and economic structures, and budget outlays will change reflecting the priorities of the new government.

Without any doubt, education will come under the microscope. Until recently, there was almost complete racial segregation in both primary and secondary education for the four racial groups (blacks, coloureds, Asians and whites) as defined in that country, and the separate facilities were highly unequal. This article makes a contribution to the literature by analysing the extent of inequality in resource allocation in education in South Africa and how this has changed over time. I show also that education and earnings distribution have been related in South Africa. The implication is that any reforms which introduce a more equal distribution of education might result in a distribution of earnings that is less unequal in the longer term.

Section II of this paper outlines the approach taken to measuring equality in resource allocation in education. Section III discusses the results for two cohorts in South Africa, one aged six in 1970 and one aged 6 in 1985. The results for South Africa are compared with those for developed and developing countries. It is shown that while the distribution of resources in education has become more equal over time, substantial inequalities remain and the overall allocation of resources more closely approximates that in developing than developed countries. Section IV discusses briefly the major different hypotheses on education (and its distribution) and income distribution: the views of the human capital school are contrasted with those who argue that education explains very little of the distribution of earnings. Section V is empirical, and examines the relationship between education and earnings distribution in South Africa. The evidence suggests that increases in the average level of education and a more equal distribution of education have been associated with a more equal distribution of earnings. Section VI concludes the paper mentioning certain policy implications.

II. Measuring Equality of Resource Allocation in Education

One common approach to measuring inequality in resource allocation in education in South Africa has been to consider average state spending per pupil across the various racial groups (see, amongst many others, Rose, 1970; Malherbe, 1977; Corke, 1979). This, however, gives only part of the story, because it does not take into account the number of years that different children attend school. An alternative approach is to examine how evenly state resources are spent on any cohort over its formal education years. This can be done applying a Lorenz

curve framework, traditionally used to analyse income distribution, to education. Percentage of the cohort is compared with percentage of resources devoted to the education of that cohort (Mingat and Tan, 1985). Provided that state expenditure per pupil at each level of education and the number of years spent at each level by all pupils/students is known, it is a relatively simple matter to determine the distribution of state resources in education for the cohort over time.

This may be explained as follows. Let c_i represent the proportionate share of the cohort with the i th level of education. It is assumed that members of the cohort receive either no education whatsoever, primary education, primary and secondary education, or primary, secondary and tertiary education. (This abstracts somewhat from reality where pupils may drop out at any grade). Let y_i represent the number of years spent at the different levels of schooling (assumed to be 7, 5 and 4 years for primary, secondary and tertiary education in South Africa). Let r_i represent the spending per student per year at any level of education. It then follows that the percentage of total resources spent on the education of the cohort received by those who obtained the i th level of schooling is given by:

$$\frac{c_i y_i r_i}{\sum_{i=1}^N c_i y_i r_i} \times 100$$

Completing this exercise for all cohorts provides the information needed to draw a Lorenz curve.

III. Results for South Africa

I obtained data for two cohorts - one aged 6 in 1970 and one aged 6 in 1985. Enrolment ratios are used for c_i . These are shown for each of the racial groups in Table 1 for both 1970 and 1985. Despite very encouraging improvements in black enrolments, the differences between whites and blacks were still marked in 1985 and 20 per cent of the relevant black age group did not enter primary school at this time. Enrolment ratios for Asians and coloureds fall in between those of blacks and whites. It is assumed that the enrolment ratios in 1970 pertained over the life of a cohort aged 6 in 1970 and those in 1985 remain so over the formal education years of a cohort aged 6 in 1985. Although this assumption can be questioned, it must be borne in mind that a comparison is being made between two time periods and the same assumption has been used in both cases.

TABLE 1
Enrolment Ratios (C.) in South Africa 1970 and 1985

	Blacks		Asians		Coloureds		Whites	
	1970	1985	1970	1985	1970	1985	1970	1985
Primary	65	80	100	100	90	96	100	100
Secondary	10	35	58	95	26	57	84	95
Tertiary	0.5	1	5	15	2	4	20	28

Source: Calculated from Central Statistical Services (1986), Department of Statistics (1974), and taking account of Trotter (1976); Corke (1979-80) unpublished; Blignaut (1981), as well as discussions held with the Department of Education and Training, the Department of National Education and the Education Unit at the University of the Orange Free State.

Table 2 shows spending per pupil by level of education in 1970 and in 1985 for the four population groups in South Africa. Differences are again most dramatic between whites and blacks at the primary and secondary level; while the ratio of state spending per black child to that per white child has increased over time, state spending per black child at the primary level was little over one-tenth of that per white child in 1985.

There are three reasons for the huge disparities in spending between racial groups. Firstly, there are major differences in teacher qualifications: around 50 per cent of black teachers in the mid-eighties still did not have formal educational qualifications much higher than standard ten (grade 12), while almost all white teachers had either three or four years of education beyond this (Department of Education and Training, 1987). Despite the fact that the government moved towards paying equal salaries for equal qualifications and experience during the 1980s, differences in spending will persist while differences in qualifications of teachers remain substantial. Secondly, there are sizeable differences in pupil:teacher ratios: although the average pupil-teacher ratio in black schools fell from around 58:1 in 1970 (Blignaut, 1981) to around 42:1 in 1985, it remained way above that in white schools, where the average was roughly 19:1 in 1985 (National Manpower Commission, 1987). Finally, the balance of the difference in spending per pupil related to different operational outlays between schools catering for the different racial groups.

TABLE 2
Spending per Pupil by Level of Education (R current)

	Blacks		Coloureds		Asians		Whites	
	1970	1985	1970	1985	1970	1985	1970	1985
Primary	21	249	92	692	112	937	366	2,044
Secondary	113	552	120	1,073	156	1,474	624	2,504
Tertiary	2,087	5,500	1,155	5,500	1,384	5,500	936	5,500

Source: Malherbe, 1977. Trotter, 1988.

Tables 3 and 4 give the results of the computations, and these are reflected also in Figure 1. The relative sizes of each of the racial groups in the cohorts were taken from the Department of Statistics (1974) for the earlier period and from Mostert and Van Tonder (1985) for the later period.

The results for 1970, not surprisingly, show a very unequal distribution of resources in education. Although blacks constituted over 74.3 per cent of the relevant cohort in 1970 (Table 14), they would have received only 17.2 percent of all resources devoted to the education of that cohort. Whites would have received 67.1 percent of all resources spent on the education of the 1970 cohort, although they represented only 12.2 per cent of the cohort. Overall, 27.1 percent of the cohort did not receive any of state resources spent on the education of the cohort and 3.1 percent of the cohort obtained over ten times its proportionate share of resources.

A Gini coefficient is also calculated. The Gini coefficient used here is defined as:

$$G = 0.5 \sum_i \sum_j (c_i y_j r_j - c_j y_i r_i)$$

where c_j represents the proportionate share of all groups other than group i .

The higher the value of the Gini coefficient, the greater the inequality in distribution of resources in education. The Gini coefficient for the 1970 cohort is 0.66.

The distribution of resources amongst the 1985 cohort is not as unequal as that for the 1970 cohort. Around 17 percent of the 1985 cohort will not receive any of the resources spent on the education of the cohort between 1985 and the turn of the century, while at the top end of the scale, 3.7 percent of the cohort will receive just over 7 times their proportionate share of resources. The Gini coefficient is 0.53. This is a 20 percent improvement in the Gini coefficient for the 1970 cohort, but still shows substantial inequality.

FIGURE 1 Distribution of Resources in Education in South Africa
1970, 1985 and 1985 adjusted for hypothetical changes.

TABLE 8
Characteristics of Income Distributions for Economically
Active Males by Level of Education, 1960 and 1970

Years of Education	Year	Whites Median ^b			Coloureds Median ^b			Asians Median ^b		
		R	DN	G	R	DN	G	R	DN	G
0	1960	566	2.82	0.66	147	1.41	0.45	220	2.08	0.61
1-7		1,103	1.27	0.46	224	1.93	0.51	335	1.86	0.63
8-12		1,728	1.05	0.40	427	1.74	0.46	447	1.70	0.55
Degree		3,394	1.03	0.38	1,740	c	c	1,594	c	c
0	1970	852	3.40	0.63	244	1.41	0.46	427	1.53	0.57
1-7		1,933	1.36	0.44	439	1.45	0.47	614	1.32	0.49
8-12		2,923	1.04	0.37	861	1.35	0.52	868	1.26	0.50
Degree		5,697	1.03	0.49	d	d	d	d	d	d

Source: Trotter, 1977

b: Median Incomes in current values throughout

c: Measures cannot be calculated, as more than 20% are in last (open) class

d: Measures cannot be calculated, as more than 50% are in last (open) class

TABLE 9
Characteristics of Income Distributions for
Economically Active Males by Level of Education, 1980

Years of education	Whites			Coloureds		
	Median R	DN	G	Median R	DN	G
0	6775	1.75	0.43	923	1.44	0.47
1-7	5798	1.36	0.41	1475	1.18	0.46
8-12	8877	1.15	0.29	2751	1.46	0.46
Degree	15363	1.12	0.40	8454	1.26	0.36
	Asians			Blacks		
0	2064	1.41	0.42	866	1.72	0.44
1-7	2255	1.16	0.38	1272	1.27	0.40
8-12	3416	0.24	0.41	1781	1.04	0.34
Degree	9437	1.23	0.43	5282	1.28	0.36

Source: Calculated from Unpublished Statistics. Central Statistical Services, 1980.

From Tables 8 and 9 there are 26 possible comparisons between one educational level and the next. In sixteen cases, both the Gini coefficient and the dispersion index fall as educational level rises. In six cases, the results are ambiguous with the indexes moving in opposite directions. In two of these ambiguous cases, viz. that of Asians between 1 and 7 years and 8 and 12 years of education in 1970 and 1980, the dispersion index falls significantly whereas the Gini coefficient increases only marginally. When skewness indexes were calculated as well, it was found that in both these ambiguous cases the measure of skewness fell as educational level rose. Perhaps there are then another two cases of declining income inequality with increased education. In four cases only, the dispersion indexes and Gini coefficients both increase as educational level rises.

TABLE 10
The Distribution of Income by Level of
Education for Females (1980)

Years of education	Whites			Coloureds		
	Median R	DN	G	Median R	DN	G
None	2978	1.70	0.47	317	1.92	0.48
1-7	1474	2.52	0.48	587	2.36	0.51
8-12	4230	0.90	0.29	1673	1.31	0.39
Degree	5583	0.79	0.39	4094	0.74	0.27
	Asians			Blacks		
None	1061	1.36	0.42	240	2.23	0.66
1-7	1323	1.04	0.40	404	2.25	0.59
8-12	1864	1.32	0.41	497	1.75	0.45
Degree	4422	0.74	0.32	2392	0.97	0.34

Source: Calculated from Central Statistical Services, Unpublished Statistics, 1980.

Table 10 shows the distribution of incomes for females in each racial group by educational level for 1980 (females had not been included in Trotter's study). There are 12 comparisons that can be made between one educational level and the next. In seven cases, an increase in educational level is accompanied by a fall in the dispersion index and the Gini coefficient. In two cases the results are ambiguous with the Gini coefficient moving in the opposite direction to the dispersion index. In three cases only was an increase in education accompanied by an unambiguous worsening in the distribution of income.

An improvement in the average level of education has thus generally been associated with an improvement in the dispersion of earnings for both males and females.

One valid criticism of the above analysis is that income distribution is examined for all males and females irrespective of age. If the distribution of education is not similar for cohorts, however, the results could be distorted. In consequence, the distribution of earnings for specific age groups is also examined. In view of the size of the sample and the general stability of earnings between ages 35 and 54, these age groups were selected. I obtained data from Central Statistical Services for the two polar extreme groups only (i.e. blacks and whites) and restricted the analysis to two educational levels only where the samples were very large, namely primary school (Std. 5) and secondary school completed (Std. 10) (raw data available from the author on request). The analysis below considers the distribution of earnings of blacks and whites together, although the conclusions remain valid when blacks and whites are considered separately (see Marais, 1991).

TABLE 11
Income Distribution for Black and White Males,
Age 35-44 and 45-54 by Educational Level (1980)

Age: 35-44

	Lowest	2nd Lowest	Middle	Second Highest	Highest
	20%	20%	20%	20%	20%
Std. 5	0.1	10.1	22.3	22.3	45.2
Std. 10	5.2	15.0	19.2	26.3	34.3

Age: 45-54

	Lowest	2nd Lowest	Middle	Second Highest	Highest
	20%	20%	20%	20%	20%
Std. 5	0.6	8.7	19.3	19.7	57.1
Std. 10	5.0	14.9	19.7	25.5	34.1

Source: Calculated from Central Statistical Services, Unpublished Statistics.

Table 11 shows that the distribution of earnings for black and white males was more unequal for those with a standard 5 education than for those with a standard 10 education: whereas the lowest 20 percent of black and white males aged 35-44 with a Std 5 certificate earned only 0.1 percent of all black and white male earnings with a Std. 5 certificate, the comparative figure for Std. 10 was 5.2 percent. For the top 20 percent in each educational group, the relevant percentages were 45.2 and 34.3

A similar trend is observed for those aged 45-54 - incomes were far more unequally distributed for black and white males with a standard 5 than those with a standard 10 qualification.

Gini coefficients were calculated for each of the groups in Table 11. Table 12 summarises the results. Clearly, the Gini coefficient falls significantly as educational level rises for both age groups.

TABLE 12
Gini Coefficients - Black and White Males
by Educational Level (1980)

Age	Std 5	Std 10
35 - 44	.41	.28
45 - 54	.45	.28

Source: Calculated from Central Statistical Services, Unpublished Statistics.

The same analysis was conducted for females in these age groups but it was necessary to contend with an additional problem. Whereas it is difficult to imagine why those males aged 35 - 54 would not earn anything voluntarily, the position is somewhat different for females who may be involved in childcare. It is not clear whether those women whose earnings were zero should be included in the analysis, particularly since many women in these groups earned nothing (approximately 40% of the relevant group in each case). Two sets of calculations were in consequence undertaken and, irrespective of whether those without earnings are included or excluded, the results show that the Gini coefficient is always lower for those with a Std 10 than those with a Std 5 qualification (see Table 13).

TABLE 13
Gini Coefficients for Black and White Females of
Selected Age Groups by Level of Education (1980)

Age	(Includes Women Without Earnings)	
	Std 5	Std 10
35 - 44	0.65	0.59
45 - 54	0.66	0.60
	(Excludes Women Without Earnings)	
35 - 44	0.34	0.27
45 - 54	0.34	0.31

Source: Calculated from Central Statistical Services, Unpublished Statistics.

The distribution of earnings for both black and white males and black and white females thus improved as the level of education increased. This evidence is consistent with the Marin and Psacharopoulos (1976) version of the human capital hypothesis.

(iii) The Distribution of Education and the Distribution of Earnings

The distribution of education changed amongst each racial group (males) between 1960 and 1980 and so did the distribution of earnings. Table 15 shows that for coloured and Asian males, the median level of education improved consistently over the twenty-year period, the distribution of education improved and the distribution of incomes also improved. Although the distribution of education improved for white males, however, the distribution of income worsened. (Comparable data for blacks could not be obtained).

TABLE 14
Education Distribution and Income Distribution in
South Africa - Males - 1960, 1970 and 1980

	Whites			Asians			Coloureds		
	1960	1970	1980	1960	1970	1980	1960	1970	1980
Education									
Median No. of years	8.99	9.66	10.55	6.21	7.26	8.43	4.08	5.39	6.49
Dispersion Index	0.41	0.37	0.30	0.75	0.55	0.52	1.75	1.42	1.00
Income									
Dispersion Index	0.85	1.02	1.22	1.83	1.44	1.23	2.33	1.78	0.95
Gini Coefficient	0.38	0.39	0.40	0.51	0.46	0.43	0.52	0.50	0.44
Skewness	-0.08	0.06	0.28	-0.03	0.33	0.29	0.23	0.30	-0.21

Source: For 1960 and 1970, Trotter (1977)

Original calculations for 1980 from Central Statistical Services 1980, Unpublished Statistics.

A cross racial comparison provides our final piece of supportive evidence. Table 15 shows the distribution of education and the distribution of earnings of women in 1980 for all racial groups. Moving from whites to Asians to coloureds to blacks, the average level of education falls consistently, the distribution of education was consistently more uneven and so was the distribution of income.

The evidence here, although by no means compelling, suggests that a better distribution of education might be accompanied by a better distribution of earnings, and tends to support the human capital hypothesis.

TABLE 15
The Distribution of Education and the Distribution
of Income - Women (1980)

Level of Education	Whites	Coloureds	Asians	Blacks
Education	11.19	6.60	7.97	4.89
Median No. of Years	0.25	0.90	0.72	1.59
Dispersion Index				
Income	0.91	2.06	1.30	2.39
Dispersion Index	0.32	0.49	0.40	0.55
Gini Coefficient	0.11	1.25	1.21	0.22
Skewness	R4474	R933	R1709	R436
Median				

Source: Calculated from Central Statistical Services, Unpublished Statistics 1980.

VI CONCLUSION AND POLICY IMPLICATIONS

This paper had two main objectives: one, to analyse the distribution of resources in education in South Africa; two, to examine the relationship between education and the distribution of earnings in that country.

Using a Lorenz curve approach, it was shown that the distribution of resources in education, especially between racial groups, has been highly unequal. It has, however, become significantly more equal over time. The Gini coefficient for the distribution of government resources in education was estimated at 0.66 for a cohort aged six in 1970, but was 0.53 for a cohort aged six in 1985. Although the Gini coefficient fell by around 20 per cent, the distribution for the 1985 cohort still more closely resembles that for developing countries (where the Gini coefficient was estimated at 0.63 based on 1980 data) than that for developed countries (where it was estimated to be 0.27).

On the issue of education and the distribution of income, the views of the human capital school and their opponents were briefly discussed, and it was argued that there is no generally accepted theory on the relationship between education and income distribution. Empirical evidence was offered for South Africa, and it was concluded that there is some support for the human capital doctrine on the relationship between education and earnings distribution (especially the Marin and Psacharopoulos version). In particular, the evidence indicated that: investment in education has been directly related to earnings across racial groups; an increase in the average level of education has been associated with a narrower dispersion of earnings; and a more equal distribution of education has been associated with a more equal distribution of earnings.

One policy implication is that a reforming government that endeavoured to distribute resources in education more equally might simultaneously address in part another issue that is at the heart of much social and political discontent in the country, namely, the unequal distribution of income.

This more equal distribution of resources in education would of course require either greater total spending on education or a reallocation of resources away from education for whites towards education for other racial groups, especially blacks. Given obvious budgetary considerations (South Africa already spends around 4.5 to 5 per cent of GDP on education), at least some redistribution of resources seems inevitable.

There are three ways that a more equal distribution of resources in education might be achieved: teachers could be redistributed between schools (especially since there are major differences in qualifications of teachers and pupil:teacher ratios); teachers and pupils could be redistributed between schools; or government could redistribute funds between schools (possibly through some kind of voucher scheme) and leave schools free to employ whatever staff they wish. As both the former methods have all the problems of deliberate social engineering associated with them (bussing in the United States in the 1960s remains controversial), there may be more scope for a voucher scheme, characterised by equal state outlays per student on the one hand, and much greater autonomy and freedom for parents (and their children), teachers and schools (see Marais, 1991), on the other. The implications of this are not examined here - indeed, this would constitute a paper of its own.

An increase in spending on the education of blacks holds the promise also of efficiency gains; elsewhere, Marais (1991) has shown that the rate of return on primary education for blacks could be as high as around 40 per cent, while returns on all levels of education for whites are well below half of this estimate. There is thus good reason to be optimistic about reforms in education as an avenue for addressing some of the problems faced by the country.

FOOTNOTES

- 1 Department of Economics, University of Western Australia. This article is based on chapters 3 and 4 of my unpublished doctoral thesis, The Economic Benefits of Education in South Africa, completed through the University of South Africa.
- 2 Income and enrolment figures for 1985 exclude the Transkei, Bophutatswana and Venda.
- 3 The dispersion index was calculated using the first and last quintiles and the median, i.e.

$$DN = \frac{Q_{80} - Q_{20}}{Q_{50}}$$

I am indebted to P. Fridjohn of the Department of Statistics at the University of Witwatersrand for his assistance with Tables 9 and 10 - see also Marais, M.A. and Fridjohn, P. (1986).

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