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Apartheid's Enduring Legacy: Inequalities in Education[1]

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This paper provides a broad overview of the economic dimensions of the educational situation in South Africa a decade after the political transition. An important question is whether changes since the transition have substantially ameliorated the role of race in education. Census and survey data show that quantitative educational attainment differentials (years of education) have been substantially reduced, but qualitative differentials remain larger. Despite massive resource shifts to black schools, overall matriculation results did not improve in the post-apartheid period. Thus the school system contributes little to supporting the upward mobility of poor children in the labour market. The persistence of former racial inequalities is reflected in extremely poor pass rates in mainly black schools (the majority of schools), with high standard deviations. Regressions of matriculation pass rates from school level data show that racial composition of schools—as proxy for former school department—remains a major explanatory factor besides socio-economic background (as measured by school fees set by school governing bodies) and educational inputs (measured by teacher–pupil ratios and teacher salaries as proxy for qualifications and experience). Furthermore, remarkable differentials in performance among black schools cannot be accounted for by socio-economic background or teaching resources, pointing to the importance of school management. The malfunctioning of large parts of the school system appears largely a problem of x-inefficiency rather than allocative efficiency. This requires urgent attention to the functioning of poorly

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performing schools, to permit continued upward mobility of the largest part of the workforce as well as to support sustained economic growth.

JEL classification: *I21*

1. Introduction

This paper provides an overview of the educational situation in South Africa a decade after the political transition, with the focus on its economic dimensions. This overview often draws on the author's own previous work, with the empirical contribution confined to a production function analysis of educational outcomes. An important question is whether changes since the transition have substantially ameliorated the role of race in education. As comparative inter-temporal data are scarce, this paper thus analyses recent educational outcomes to show that race, and the race-based former school systems, still remain the most pervasive determinants of educational outcomes.

Section 2 addresses the South African educational context, in terms of inequality in educational attainment and quality. An overview of educational inequality in Section 2.1 shows that quantitative educational attainment differentials have been substantially reduced, but Section 2.2 shows that quality differentials are enduring. Section 2.3 touches on sources of inequality other than race, including evidence of growing educational stratification among blacks. Section 3 analyses school performance and its determinants, using regression analysis and Section 4 provides a brief economic perspective on school education policy. Section 5 concludes.

A case will be made that the school system still largely fails in enhancing upward mobility of poor children in the labour market, *inter alia* because of the continued weak performance of many black schools. The empirical analysis will show that racial composition of a school—as proxy for former school department—remains a major determinant of matriculation pass rates. The conclusion points to enduring socio-economic and racial differentials in school outcomes, but also cautions against seeking the solution mainly through resource shifts. For as Hanushek (2002b: pp. 3–4) has remarked, 'Eager to improve quality and unable to

do it directly, government policy typically moves to what is thought to be the next best thing–providing added resources to schools. Broad evidence from the experience in the United States and the rest of the world suggests that this is an ineffective way to improve quality.' The empirical analysis in this paper fully supports this perspective: for resource inputs to improve educational quality may first require some other conditions for quality education to be met, e.g., well-functioning school and education management, and effective quality control systems. The conclusions are alarming in that they show that quality differentials between schools are large and enduring, that despite fiscal resource shifts there has been little reduction in these differentials, and that there are major impediments to overcoming these qualitative differences in school performance.

2. The Education and Skills Context

2.1. Educational Attainment

The legacy of apartheid education, with racially segregated schools and under-resourcing of schools for blacks, is still evident in large educational differentials between whites and blacks. A perhaps even greater impact was on educational quality differentials, discussed in Section 2.2. Race remains the main correlate of both education quality and quantity, but race and class are to some extent conflated (despite growing socio-economic cleavages within the black population).

Census data showed that quantitative educational attainment differentials (in mean years of education completed) had been substantially reduced even during the apartheid era (Louw *et al.*, 2005). The black cohort born in 1920 had on average attained 7.2 fewer years of education than whites, the 1950 cohort 6.0 years less, the 1960 cohort 4.9 years less, the 1970 cohort 3.6 and the 1980 cohort only 2.3 years less. There were still large differentials in mean attainment by race and urban versus rural location, but gender differences were quite small.

High levels of educational inequality had given rise to large earnings inequalities. Thus it is significant that inequality in educational attainment had declined both within and between race groups. Mean educational attainment level rose and the coefficient of

variation declined over the 30-year period while the variance declined even among blacks.[2] Despite apartheid, black educational attainment grew apace in the 1970s and 1980s, although growth levelled off somewhat in the 1990s. Up to age 15 there is now almost universal school enrolment, but there is a noticeable drop out of the school system at the upper secondary level, and high matric failure rates reflect weak educational quality.

While the white population has educational levels almost similar to those for developed countries, backlogs still plague other groups. Altogether 70% of whites above age 26 had completed matric or more; almost 15% had a degree. In comparison, only 19% of blacks over 26 years had completed matric or more and only 1.4% had graduated. For younger cohorts of blacks, the educational lag behind whites had narrowed considerably. There is a dramatically higher proportion (36.2%) with at least matric among the black cohort aged 26–30, but the number of university graduates had not yet shown such improvement, in part because poor school quality limited university access.

In 1970, only 43,000 people matriculated; in 1990, 191,000 did and in 2005, 347,000 did. The growth rate of matriculants of 7.8% per year in the period 1970–1990 thus dropped to a still respectable 4.1% per year in the next 15 years. However, the annual rate did slow in the immediate post-transition period and only recovered recently, as Figure 1 shows—some of this improvement in pass

[2] Lam (1999) discussed the significance of this finding. As the earnings function literature shows that earnings are log-linearly related to educational attainment, even a reduction in mean-invariant measures of educational inequality—such as the coefficient of variation—does not guarantee a reduction in earnings inequality if the variance increases with constant returns to education. If the logarithm of earnings of worker i is

$$\log y_i = \alpha + \beta S_i + u_i$$

(y_i is earnings, S_i schooling, u_i residual uncorrelated with schooling), then

$$\text{var}(\log\ y_i) = \beta^2 \text{var}(S_i) + \text{var}(u_i)$$

Thus earnings inequality (variance of log-earnings) is a linear function of variance in schooling. If schooling inequality is measured by the coefficient of variation $CV = \sigma/\mu$ (standard deviation divided by mean), which is mean-invariant, then greater earnings inequality is possible despite reduced schooling inequality. Lam showed that in Brazil the standard deviation for schooling indeed rose less than the mean for cohorts born during 1925–1950. Thus, although the coefficient of variation declined, lower schooling inequality did not reduce high earnings inequality as the variance of schooling attainment rose. This was unlike the case in South Africa.

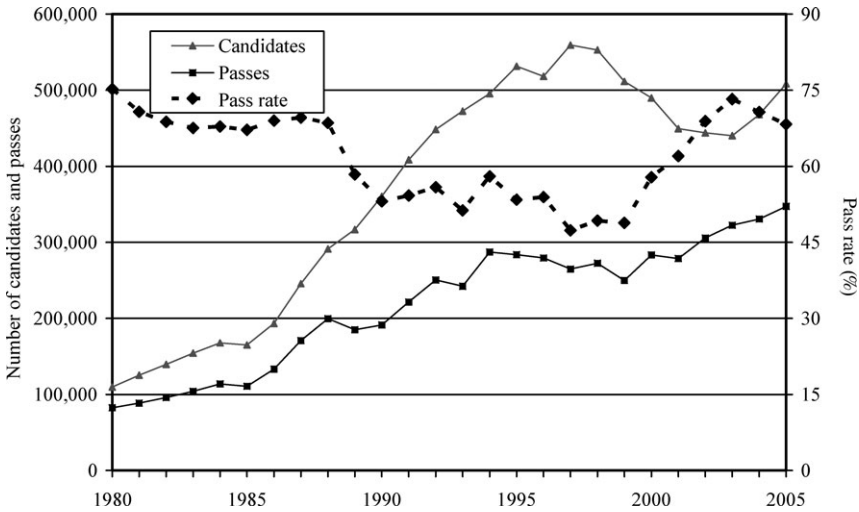

Figure 1: *Matric Candidates, Passes and Pass Rate, 1980–2005. Source: SA Institute of Race Relations, 2001, p.156; Department of National Education, website.*

rates resulted from a reduction in the number of candidates due to restrictions introduced on over-age children in the school system. The performance in terms of endorsements or university exemptions had not improved as much. The 16,000 endorsements obtained in 1970 grew at 6.7% per year to 60,000 in 1990, but thereafter growth decelerated to a paltry 2.4% per year to arrive at almost 87,000 exemptions in 2005.

2.2. *Educational Quality*

Many black pupils now attend formerly white schools,[3] while among formerly black schools there is great variation in quality.

[3] Data for 1997 for seven provinces (all but Mpumalanga and Eastern Cape) showed that, even so soon after the transition, about 22,000, or 5.4%, of the 400,000 pupils in mainly white schools (those with more than 70% white pupils) were blacks, while in 'mixed' schools (where no race group constituted more than 70% of pupils), 197,000 out of 488,000 (40.3%) were black and 104,000 (21.3%) white. Nevertheless, most black pupils (95.8%) were still in predominantly black schools. In 2003, 93.2% of black matric candidates were in schools where most matriculants were black. Some of these schools, however, could formerly have been schools restricted to other race groups.

South African schools generally perform at an even lower level than most of their African counterparts, despite greater South African resources, less acute poverty and more educated parents. International tests show that intervention is required at a much earlier stage than matric. Promotion to higher grades appears to be relatively easy, thus educational attainment (years of education completed) may exaggerate progress in cognitive levels mastered.

Taylor *et al.* (2003: p. 41) summarised some evidence on educational quality as follows: *'Studies conducted in South Africa from 1998 to 2002 suggest that learners' scores are far below what is expected at all levels of the schooling system, both in relation to other countries (including other developing countries) and in relation to the expectations of the South African curriculum.'* This view is supported by a growing body of evidence:

- The 1993 Statistics for Living Standards and Development household survey showed severe quality problems in large parts of the education system (Fuller *et al.*, 1995; Van der Berg *et al.*, 2001). Blacks aged 13–18 had reached 78–86% of the years of education attained by whites, but their literacy scores were 50–63% and their numeracy scores only 36–47% of white levels. Case and Deaton's (1999: 1078, table VIII) regression results indicated that the average cognitive backlog experienced by black teenagers would have required 10 years of schooling to bring them on par with their white counterparts.
- The 1995 MLA (Monitoring Learning Achievement) study found that South African Grade 4 pupils' numeracy score of 30% was by far the lowest of 12 participating African countries. In literacy, South Africa outperformed only 3 of the 12 countries.
- South Africa's performance on the Grade 6 education evaluation test conducted by the Southern African Consortium for Monitoring Educational Quality in 2000 (SACMEQ II) placed it in the bottom half of the 14 participating countries on both Reading and Mathematics (see Table 1). South Africa's high standard deviation indicated large inequality in performance; the intraclass correlation coefficient, rho (the proportion of variance between individuals that occurred between rather than within schools) was also

Table 1: *Mean Score and Scores of Poor (Low SES) and Rich (High SES) Pupils on SACMEQ II Grade 6 Reading and Mathematics Tests by Country (Arranged by Mean Scores in Each Test)*

Reading (arranged by mean score)				Mathematics (arranged by mean score)			
	Low SES	High SES	Mean		Low SES	High SES	Mean
Seychelles	561.8	594.4	582.0	Mauritius	550.0	607.7	584.6
Kenya	525.3	577.5	546.5	Kenya	546.9	587.1	563.3
Tanzania	528.8	575.2	545.9	Seychelles	532.4	567.8	554.3
Mauritius	508.3	555.1	536.4	Mozambique	527.5	532.6	530.0
Swaziland	519.1	541.0	529.6	Tanzania	509.0	545.5	522.4
Botswana	502.5	543.6	521.1	Swaziland	511.3	522.2	516.5
Mozambique	510.5	523.0	516.7	Botswana	498.9	529.8	512.9
South Africa	440.2	543.6	493.3	Uganda	496.3	519.2	506.3
Uganda	472.3	495.5	482.4	South Africa	446.8	524.3	486.3
Zanzibar	468.1	492.2	478.2	Zanzibar	474.0	483.9	478.1
Lesotho	449.2	454.5	451.2	Lesotho	448.6	444.9	447.2
Namibia	421.5	486.1	448.8	Zambia	425.5	444.8	435.2
Zambia	423.6	456.5	440.1	Malawi	428.2	442.2	432.9
Malawi	422.9	440.7	428.9	Namibia	408.7	461.3	430.9
SACMEQ Average			500.0	SACMEQ Average			500.0

Note: SES refers to socio-economic status, measured here using a proxy for affluence based on answers on household possessions obtained from the pupil questionnaire.

Source: Indicators on SACMEQ website. Available online at: http://www.sacmeq.org/indicate.htm

extremely high (Van der Berg, 2006). A government report (South Africa, Department of Education, 2003a: 102) noted the weak South African performance despite much higher expenditure per pupil. Surprisingly also, despite its greater fiscal resources, South Africa lagged many countries in the region in availability of textbooks in the classroom, particularly in Mathematics.

- In the 2003, Trends in International Mathematics and Science Study (TIMSS), South Africa Grade 8 students scored 264 for Mathematics compared to the average of 467 for all 53 participating countries, and 244 for Science, compared to the international average of 474 (Human Sciences Research Council, 2005). This was no improvement on the 1999 scores (see Table 2). South Africa maintained its bottom rank, below all five other participating African countries (Egypt, Tunisia, Morocco, Botswana and Ghana) (Human Sciences Research Council, 2005; Taylor *et al.*, 2003). While former white schools performed just below the international average, the scores in former black schools were only half as much in Mathematics and even worse in Science.
- The 2003 Systemic Evaluation of 54,000 Grade 3 pupils indicated serious shortcomings in education quality. For life

Table 2: *Mathematics and Science Scores in TIMSS Grade 8 Tests in Comparative Perspective, 1999 and 2003*

	Mathematics		Science	
	1999	2003	1999	2003
International average[a]	487	467	488	474
South Africa				
Country average	275	264	243	244
Former white schools	—	456	—	468
Former black schools	—	227	—	200

Source: Human Sciences Research Council (HSRC) 2005.
[a]International sample changed between surveys.

skills and listening comprehension, scores were 54 and 69%, but for reading comprehension only 38% and for numeracy 30% (South Africa, Department of Education, 2003b: p. viii–ix). Here too there were great inequalities.

Figure 2 shows lowess (locally weighted) regressions for pupil mathematics scores against socio-economic status (SES) for South Africa and for 13 other African countries combined in SACMEQ II. Apart from at the top of the SES distribution, South African pupils under-perform compared to their equally poor counterparts, despite more favourable pupil/teacher ratios, teacher qualifications and availability of textbook.

Table 3 shows that the number of candidates who wrote Mathematics at the Higher Grade almost halved between 1997 and 2001, and the pass rate increased from one-third to 56%. Worryingly, however, only 15.5% of black candidates passed this exam—in all, only just over 3,000 pupils. As a good performance in Higher Grade Mathematics is required for entry into university studies in Science, Engineering, Medicine and Commerce, this is particularly alarming from the perspective of the skills constraint and black access to skilled positions. Even at Standard Grade, the

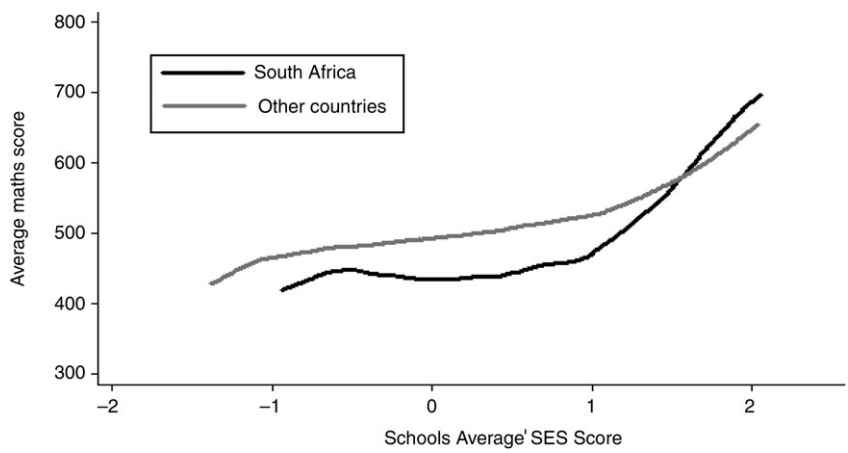

Figure 2: *Lowess Regression on School Mean Maths Score by Mean SES Level of School, South Africa vs. Other Countries. Source: Own Calculations Based on SACMEQ Data*

Table 3: *Higher and Standard Grade Matriculation Passes in Mathematics and Physical Science for All Pupils and Black Pupils*

	Higher grade				Standard grade				Higher plus standard grade	
	Wrote	Pass	Percentage of candidates	Percentage of all matriculants	Wrote	Pass	Percentage of candidates	Percentage of all matriculants	Pass	Percentage of all matriculants
Mathematics										
1997	68,500	22,800	33.3	4.1	184,200	66,900	36.3	12.0	89,700	16.0
1998	60,300	20,300	33.7	3.7	219,400	68,600	31.3	12.4	88,900	16.1
1999	50,100	19,900	39.7	3.9	231,200	82,200	35.6	16.1	102,100	20.0
2000	38,520	19,327	50.2	3.9	245,497	79,631	32.4	16.3	98,958	20.2
2001	34,870	19,504	55.9	4.3	229,075	72,301	31.6	16.1	91,805	20.4
2002	—	20,528	—	4.6	—	101,289	—	22.8	121,817	27.4
2000:Blacks	20,243	3,128	15.5	—	180,202	41,540	23.1		44,668	—
Physical Science										
1997	76,100	27,000	35.5	4.8	65,200	35,200	54.0	6.3	62,200	11.1
1998	73,300	26,700	36.4	4.8	83,800	43,200	51.6	7.8	69,900	12.6
1999	66,500	24,200	36.4	4.7	93,500	44,000	47.1	8.6	68,200	13.3
2000	55,699	23,344	41.9	4.8	107,486	54,884	51.1	11.2	78,228	16.0
2001	48,996	24,280	49.6	5.4	104,851	45,314	43.2	10.1	69,594	15.5
2002	—	24,888	—	5.6	—	70,763	—	15.9	95,651	21.6
2000:Blacks	33,657	5,136	15.3	—	77,680	32,874	42.3	—	38,010	—

Source: South Africa, Department of Education, 2001b. National Strategy for Mathematics, Science and Technology in general and further education and training. Pretoria: June, Table 1, p. 8 and Table 2, p. 12; South Africa, Department of Education 2001c. *Preliminary Report: 2001 Senior Certificate Examination.* Pretoria, Spreadsheet Total (1); and South Africa, National Treasury 2003. *Intergovernmental Fiscal Review 2003*, Pretoria, Tables 4.18 and 4.19.

Table 4: *Matric-Aged Cohort and Matriculation Results in Public Schools by Race, 2003*

	Black	Coloured	Indian	White	Total	Black share (%)
Matric-aged cohort	819,700	76,400	21,800	66,900	984,800	83
Pass matric	229,871	27,988	15,673	45,883	323,057	71
Maths passes	96,949	10,424	9,971	29,387	148,582	65
Endorsements	42,310	5,523	8,988	24,000	82,265	51
Higher grade maths passes	9,669	1,494	3,945	11,942	27,671	35
Higher grade maths D symbol (50%) or better	3,768	884	2,749	8,969	16,822	22
A-aggregate mark	833	405	1,871	6,503	9,929	8

Source: Own calculations from matriculation data obtained from Department of Education.

success rate for blacks of 23% was below the national average of 32%. Only 4.6% of all matriculants passed Mathematics at the Higher Grade in 2002. The performance of black students in Physical Science was as perturbing. Only 27% of all matric candidates passed Mathematics at some level in 2002, and just 22% passed Physical Science. This poor performance was despite the compensation of 5% per subject (marks are multiplied by a factor of 1.05) to candidates whose home language is neither Afrikaans nor English (Fatti, 2006: 56).[4] A contributory factor was that only 50 and 42% of teachers teaching Mathematics and Science, respectively, had studied these subjects beyond secondary school level (Edusource, 1999: p. 5).

In 2003, matric passes constituted 28% of the 19-year-old cohort among blacks and 68% among whites (Table 4). Almost one in 10 of the white cohort achieved a matric A-aggregate in public schools versus just more than one in a 1000 of the black cohort.

[4] Language policy in schools is currently strongly debated in South Africa. Official policy is presently mother tongue instruction up to Grade 4, but many educationists favour postponing the switch to English medium instruction, so that students first can be better trained in their home language.

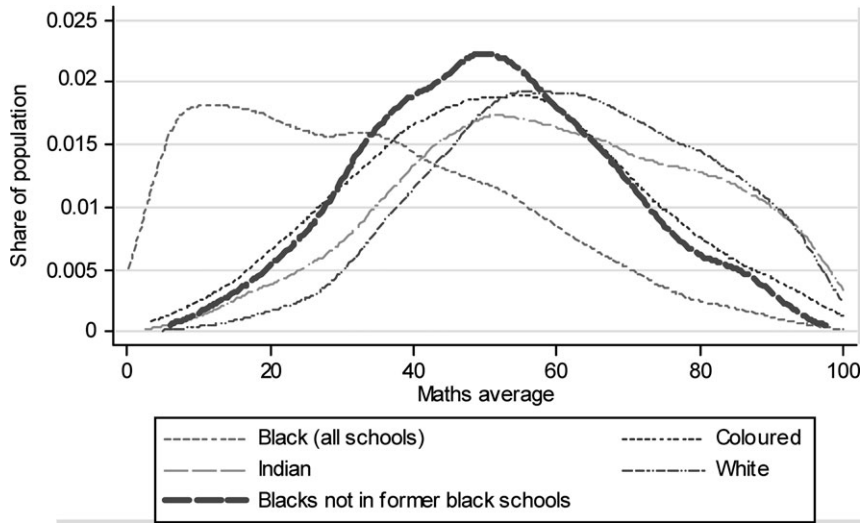

Figure 3: *Density Curves for Higher Grade Maths by Race, 2003. Source: Own Calculations from Matriculation Data Obtained from Department of Education*

Moreover, almost half of these A-achieving black candidates attended schools in which blacks were not in the majority in the matric class, probably indicating that these were former white or Indian schools. Figure 3 shows the results in Higher Grade Mathematics by race group. This was already a select group, as few black pupils entered for Higher Grade Mathematics. The results of black candidates in mainly black schools generally were dismal: the mode lay well below 20. In contrast, black students outside mainly black schools also performed much better and not much different from other groups. However, this was a relatively select group within the black population: they were usually more urban and often came from a higher socio-economic background.

2.3. Other Educational Inequalities

Differential quality of school education is a major cause of unequal labour market earnings. In some Latin American countries, where

private education offers an important route to quality education, '... *individuals from the lower deciles receive a primary education whose quality (measured in terms of income generation capacity) is 35 percent lower than that of the next decile above.'* (Inter-American Development Bank, 1998: 54). Growing inequality of educational attainment among blacks contributes to increasing stratification within black society. Figure 4 shows that children from the top two black deciles progressed considerably better through the school system than their poorer counterparts, and only at about age 15 started lagging behind whites.

Children of more educated parents progress better in school and they also fare better in the labour market once they leave school. Data from the 2001 census show that for children who had matriculated, having a parent who had also matriculated virtually doubled own earnings, whereas for children with tertiary education, earnings were only 40% higher in cases where parents had matriculated. Parent education translated into higher earnings for children, whether through the quality of education, some other non-observed aspect of human capital transmitted from parents to children or parent social networks.

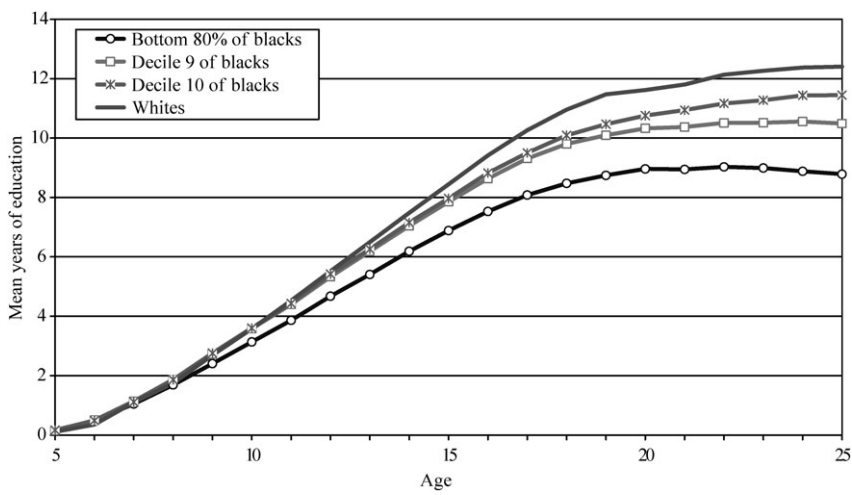

Figure 4: *Years of Education by Age, Race and Income Group, Census 2001. Source: Derived from Census 2001*

3. Analysing School Performance Using a School-Level Data Set

3.1. Inequalities in School Outcomes

Post-transition performance in numbers of pupils matric passes or endorsements for university studies has not been particularly good. Despite more resources for historically black schools, output of the school system barely kept pace with population growth. Weak matriculation performance is particularly severe in the poorest provinces, which benefited most from resource shifts.

Table 5 illustrates uneven school level performance. This is based on racial composition and school fees (a measure of socio-economic status) in 1997, linked to the matriculation results for the years 1999 and 2000. A school was identified with a particular race group if more than 70% of pupils in 1997 were drawn from that race group. There were massive differentials between the poorest and the richest school groups (average pass rate of 44 versus 97%), and between predominantly black and predominantly white schools (43 versus 97%). To put this into historical context, in 1994, the black pass rate had been 49% as against the 97% of whites. Thus there had seemingly been no improvement in pass rates in black schools in the first few years of the new dispensation, despite large resource shifts, while mainly white schools accommodated far more black pupils than before. However, mobility does not explain the failure to improve pass rates in predominantly black schools, since 96% of black pupils were still in historically black schools (which constituted some 80% of the total school population).

While pass rates in more affluent schools were almost uniformly high, predominantly black schools performed abysmally, with most recording pass rates in the range 20–60% or even lower (Table 6). In contrast, only 3 out of 179 mainly white schools had pass rates below 80%. Among poor mainly black schools that charged school fees of less than R30 per annum, the best performing quartile had a pass rate of 68%, against the 18% of the worst quartile, despite similar socio-economic status and legacies of inadequate teaching resources. The difference therefore probably should be sought in the functioning of schools and/or in the unobserved characteristics of students, since more motivated students may have chosen to attend schools which functioned better, i.e., school quality and student unobserved characteristics may have been jointly

Table 5: *Number of Schools, Mean and Standard Deviation of Average Matriculation Pass Rates in Sample by School Fee Group, 'Race Type' and Province, 1999/2000*[a]

	Number of schools	Mean (%)	Standard deviation (%)
Total sample	2,768	55.5	27.3
School fee group:			
<R20	651	43.9	23.4
R20–R49	1,177	47.8	22.2
R50–R99	496	54.1	22.2
R100–R199	82	69.7	23.2
R200–R999	243	91.9	15.0
R1000+	119	97.2	8.6
School 'race type'			
>70% black	2,106	43.3	20.3
>70% coloured	138	75.5	14.2
>70% indian	42	80.5	12.3
>70% white	179	97.3	3.8
Mixed	206	79.0	21.5
Race not specified	97	91.8	13.9
Province			
Limpopo	1,002	43.9	20.2
Free state	289	49.1	29.5
Kwazulu-Natal	784	55.7	25.5
Gauteng	367	62.2	29.5
Northern Cape	87	66.2	25.6
Western Cape	239	81.8	19.7

Source: Own calculations from Department of Education data sets.

[a]Examination data relate to the average pass rates for 1999 and 2000; school fees and racial composition relate to 1997. The racial composition or socio-economic status of some schools may have changed between 1997 and 2000.

determined. However, as geographical impediments limited mobility, differences in school functioning may be the dominant factor. Evidence presented later shows little indication of systematic mobility in response to quality differentials.

3.2. Explaining School Performance

A production function approach is now applied to this data set to analyse school performance [see Hanushek (2002c) and Filmer

Table 6: *Frequency Distribution of Schools by 'Race Type' and Pass Rate Range, 1999–2000*[a]

Range of average pass rate by school	Black	Coloured	Indian	White	Mixed	Race unspecified	Total
Numbers							
Below 20%	207				3	1	211
20–39%	743	3			11	1	758
40–59%	668	23	2		33	5	731
60–79%	342	57	16	3	45	11	474
80–100%	146	55	24	176	114	79	594
Total	2,106	138	42	179	206	97	2,768
Percentages							
Below 20%	9.8	0.0	0.0	0.0	1.5	1.0	7.6
20–39%	35.3	2.2	0.0	0.0	5.3	1.0	27.4
40–59%	31.7	16.7	4.8	0.0	16.0	5.2	26.4
60–79%	16.2	41.3	38.1	1.7	21.8	11.3	17.1
80–100%	6.9	39.9	57.1	98.3	55.3	81.4	21.5
Total	100	100	100	100	100	100	100

Source: Own calculations from Department of Education data sets.

[a]Examination data relate to the average pass rates for 1999 and 2000; racial composition relates to 1997.

and Pritchett (1999) for good overviews of this approach]. Essentially such an approach tries to measure statistically the relationship between educational inputs and outputs, after controlling for other explanatory factors such as socio-economic status.

The data consisted of matriculation pass rates for 1999 and 2000, which matched with the data for seven provinces on 1997 school resources and racial composition. The only output measure available was the aggregate pass rate of the schools. No data matching was possible for the North West province. The sample of almost 2,800 covered about half of all schools, matriculation candidates and matriculation passes nationally, and represented about 70% of the total in the six provinces covered. Thus the results applied to a fairly but not fully representative sample of about half of all schools and matriculation candidates.

The examination data set contained pass rates for 1999 and 2000, and the number of candidates who wrote the examination in 2000. The correlation between the pass rates for 1999 and 2000 ($r = 0.85$) indicated a large measure of stability in pass rates at the school level. The average pass rate over the 2 years was used as performance measure to reduce the effect of year-to-year variations, and the number of candidates in each school who wrote in 2000 was used to weight each observation (school). This was the dependent variable. The 1997 racial composition of schools provides a fair approximation of the racial composition of each school's matric class in 1999 and 2000, and 1997 educational resources and school fees (average actual fees paid) were taken as a crude proxy for these variables over the high school career. Apartheid-era resource differentials between schools had not been eliminated in 1997, so that the data captured a variety of experiences. Teacher resources were measured by pupil/teacher ratio, average teacher salaries (a measure of their qualifications and experience) or a combination of these two, viz. average teacher costs per pupil. Racial composition of schools was used as a proxy for former race departments. Mobility between schools meant that the racial composition of schools may have been endogenous, if mobility occurred in response to school quality. However, the broad pattern of mobility since the opening up of schools meant that former black schools were easily identified.

The data are summarised in Table 7. *A priori*, one would have expected matriculation pass rates to improve with higher school fees, a lower pupil/teacher ratio, higher teacher salaries, fewer black pupils and in historically better-endowed provinces. Regression results were broadly consistent with these expectations. Regression 1 in Table 8 shows that matriculation pass rates of schools were associated with pupil socio-economic background as measured by school fees, teaching resources (pupil/teacher ratio and average teacher salary), provincial location and the race category of schools. The Western Cape and Kwazulu-Natal performed significantly better than similar schools in Limpopo, the reference province. All other variables were highly significant and their signs as expected. A full log-transformation did not improve the fit. The coefficient of determination was high for a cross-sectional regression of this nature where the dependent variable, pass rates, reflects little differentiation at the upper end. Tests showed the results to be insensitive to the presence of outliers.

Table 7: *Descriptive Statistics: Schools from Six Provinces*

	Matric pass rate	Fees per pupil	Pupils per teacher	Average teacher salary
Black schools ($n = 2106$)				
Mean (%)	43	R 49	33.7	R 82,720
Standard deviation (%)	20	R 118	9.9	R 7,498
Other schools ($n = 662$)[a]				
Mean (%)	85	R 545	27.1	R 97,574
Standard deviation (%)	17	R 679	5.2	R 5,747
All schools ($n = 2768$)				
Mean (%)	56	R 194	31.7	R 87,084
Standard deviation (%)	27	R 443	9.3	R 9,756

[a]179 mainly white schools, 179 mixed schools, 138 mainly coloured, 42 mainly Indian and 97 schools for which race composition was unknown.

The coefficient of the dummy for mainly white schools indicated that, holding constant the level of school fees, pupil/teacher ratios, teacher salary level and province, a school containing mainly white pupils had a matriculation pass rate 26 percentage points higher than a similar mainly black school (the reference category). Therefore, a large part of the 54 percentage points difference between black and white schools could not be explained away by school fees, educational resources and province—and even these factors were highly correlated with race. This finding was highly disturbing, that a large part of the educational system was still unable to overcome the ravages of apartheid education. It appeared that the reason should be sought in the poor ability of many schools to convert school resources into educational outcomes, perhaps related to dysfunctional management structures.

Replacing the pupil/teacher ratio and the teacher salary by a single combined variable, the teacher cost per pupil,[5] or using a

[5] The coefficient for school fees per pupil was five times as large as that for teacher cost per pupil. This implied that school fees did more than only augment fiscal resources, possibly because school fees was spent more effectively than other school expenditures (being controlled by school governing bodies, who were closer to schools' real needs), or because school fees was a good proxy for economic status.

Table 8: *Regressions of Matriculation Pass Rates by School in Six Provinces, 1999–2000 (t-values Shown Below Coefficients)*

Dependent variable: pass rate (average 1999 and 2000)	Regression 1: All schools	Regression 2: Mainly black schools	Regression 3: Other schools
School fees per pupil (R per annum)	0.037	0.105	0.029
	(13.90)**	(9.27)**	(14.27)**
Square of school fees per pupil	−0.000011	−0.0000051	−0.00000778
	(10.58)**	(4.86)**	(10.56)**
Pupil/teacher ratio	−0.129	−0.085	−0.346
	(2.93)**	(1.90)	(2.87)**
Average teacher salary (in thousands of Rand)	0.435	0.412	0.913
	(5.95)**	(4.43)**	(5.75)**
Mainly coloured school (dummy)	23.024		
	(11.66)**		
Mainly Indian school (dummy)	24.351		
	(9.05)**		
Mixed school (dummy)	17.872		
	(9.29)**		
Mainly white school (dummy)	25.706		
	(13.00)**		
Race unspecified (dummy)	26.554		
	(10.69)**		
Kwazulu-Natal (dummy)	5.521	4.528	3.228
	(4.86)**	(3.47)**	(0.82)
Free State (dummy)	−2.001	−2.004	5.404
	(1.29)	(1.14)	(1.37)
Northern Cape (dummy)	2.332	3.929	5.379
	(1.19)	(1.23)	(1.27)
Gauteng (dummy)	−1.263	−0.713	1.337
	(1.04)	(0.48)	(0.36)
Western Cape (dummy)	7.056	3.630	12.108
	(3.65)**	(1.00)	(3.17)**
Constant	11.049	10.025	13.431
	(1.81)	(1.36)	(1.12)
N	2768	2106	662
R^2	0.59	0.12	0.48

Robust *t*-statistics in parentheses.
*Indicates 0.05 level of significance.
**Indicates 0.01 level of significance.

log specification for school fees left other coefficients relatively unaffected, suggesting that the model was not greatly influenced by the particular specification. Non-linear specifications of the pupil/teacher ratio variable did not improve the fit.

However, the bimodal distribution of school pass rates signified two underlying data generation processes rather than a single one. These processes may be better understood if they were modelled separately, thus the initial sample was split into two groups, viz. mainly black schools versus other schools. The results could be summarised as follows:

- School fees and educational resources had a significantly positive influence on matriculation pass rates in both regressions, and again this effect declined with rising school fees.
- Surprisingly, the coefficient for school fees was much larger in black schools than in other schools, pointing to strong socio-economic differentiation within dominantly black parts of the school system.
- The coefficient for the pupil/teacher ratio was statistically insignificant in mainly black schools, where high pupil/teacher ratios historically had been particularly detrimental. These results may explain why, on their own, teacher resource shifts to blacks schools may have had limited impact in improving overall educational performance. The correlation coefficient of −0.06 between the 1999–2000 matriculation results and the pupil/teacher ratio for black schools in 1997 (when apartheid-era differentials had not yet been fully eliminated) meant that less than 4% of the variation in matriculation pass rates among black schools could be explained by the pupil/teacher ratio.
- The coefficient of determination of 0.12 for Regression 2 indicated that the model left the large variation in pass rates in black schools around a low mean largely unexplained. In striking contrast, 48% of the smaller variation in matric results in other schools was explained by these few explanatory variables.
- Kwazulu-Natal's black schools fared significantly better than expected, while for other schools the Western Cape significantly outperformed other provinces.

Thus race or associated factors still constituted a major determinant of differential matriculation pass rates. These results also imply that the 'success' of the first regression in 'explaining' variation in matriculation results was in part artificial, because race composition (presumably reflecting former department) blurred the effects of other explanatory variables on school performance and ignored the two different data generating processes at work. The question then arises: which school characteristics were captured by race composition? In South African education policy circles, such differences are often ascribed to the management culture in schools of the various former racial departments. For instance, the inefficiency in converting inputs into outputs in many former black schools can be seen as a form of managerial inefficiency that dates back to the apartheid era and that educational reforms since the transition may not yet have overcome. Among blacks schools, the quarter which exceeded the total sample's average pass rate of 56% had only slightly better pupil/teacher ratios (32.5 as against 34.0), slightly better remunerated teachers (R83,900 versus R82,387) and slightly better socio-economic status (school fees of R92 versus R36 per annum) than their weaker performing counterparts. Thus performance above and below average in black schools could not be explained by differences in resources and only to a limited extent by differences in socio-economic status.

To supplement the above analysis, a regression tree methodology was also applied. The method selects a point that splits the data into two sets (or nodes in a tree) so as to give the greatest possible separation between high values and low values of the dependent variable for these sub-sets of the data. This procedure is repeated for each of the two nodes, thus a binary split is made on each node, with stopping rules (e.g., a minimum number of cases per node) determining when the splitting process should stop. This methodology was applied to the pass rate to ascertain which predictor values played a role. The results largely confirm those from the regressions. School race type was found to be the first differentiating factor. The pupil/teacher ratio never emerged as a predictor variable, not even among predominantly black schools. Higher school fees were a better predictor of improved pass rates than were more teachers. Regression tree analysis thus confirmed that race still played a strong role, while number of teachers was not an important predictor of school performance.

Unobserved characteristics such as motivation or mobility of more able students to better schools may have influenced some of these findings. However, the small magnitude of physical mobility signified that this was unlikely to provide a major explanation. A Western Cape study showed that mobility was not systematic even in urban areas. Changes in enrolment in 2000 and in 2001 were virtually uncorrelated ($r = 0.07$), and many schools experienced large enrolment increases in 2000, followed by enrolment losses in 2001 or vice versa. (Van der Berg and Achterbosch, 2001: p. 13). In the absence of information to parents and students about school quality, this lack of systematic mobility is not surprising.

Other studies on school production functions in South Africa are relatively scarce. The findings presented above accord with those of Crouch and Mabogoane (1998), who showed that much of the variation in school performance could not be explained by input variables or by controls for socio-economic status. Although Fiske and Ladd interpreted their findings differently, their regression (Fiske and Ladd, 2004: p. 250, Appendix Table B) implied that a large reduction of the Western Cape pupil/teacher ratio, from 35 to 25, would have improved the matric pass rate by only 5 percentage points, if teacher quality was left unchanged. This was swamped by dummies for the former racial departments: compared to former white schools, the negative impact of a school having been part of the former black department was 29 percentage points, and 12 percentage points in the case of the former coloured department. Using quality of Western Cape matric results rather than only pass rates leads to broadly similar conclusions (Van der Berg and Burger, 2002), that resources alone leave much unexplained that are captured by dummies for former department. But this still leaves the mystery of how to interpret the former department dummy.

Both Gustafsson (2005) and Van der Berg (2006) used hierarchical linear models (HLM, also known as multi-level models) on SACMEQ data. This richer data set allowed controls for home background variables (socio-economic status, parent education, books at home and whether the child lived with the parents), but Gustafsson (2005) notes how little (7%) of within school variance in results is explained by these factors. Socio-economic status seemed to have a limited impact on pupil performance except for the richest schools. Pupil/teacher ratios had at best a mild influence—although

Gustafsson (2005) found some evidence of non-linear effects that showed that very high class sizes may be particularly detrimental. Some other school level resources (textbooks and school facilities) influenced learning, but all inputs together accounted for only a small part of the between school variance in results.

Production functions thus appear to be consistent with a perspective that teacher resources may only play a stronger role in improving school performance in poorer schools if certain efficiency conditions are met. This may imply that, at the margin, resources may only matter conditionally. The policy implication is that additional fiscal resources by themselves may make only a limited contribution to improving educational performance. Better school management is probably most important, while availability of good teachers remains a binding constraint. Getting more qualified teachers and better management into poor schools is more than only a fiscal problem. Issues of location (urban/rural and city/township), language, race and union opposition to salary differentiation all play a role, and teacher training is slow to yield results.

4. An Economic Perspective on School Education Policy

Faced with an educational system ravaged by apartheid, the new government tackled a number of tasks simultaneously: re-unification of the education system; deracialisation of schools; curriculum; and the highly contentious introduction of outcomes-based education. Efforts aimed at more equitable access to quality schooling included shifts in the allocation of education expenditure; infrastructure investments, notably the construction and repair of school buildings; and a primary school nutrition programme reaching about 5 million school children.

South Africa allocates a large share of its national resources to public education—its public education spending ratio of 6% of GDP is high by world standards. Moreover, school education spending increased relatively rapidly immediately after the transition. Substantial further increases of fiscal resources for education do not seem viable. But larger financial flows to education did not cause a commensurate increase in real resources for schools, as fiscal resource shifts were overshadowed by salary increases for teachers (in part to eliminate apartheid-era discrimination in teacher salaries). In contrast to international experience, teacher salaries

outpaced the growth of per capita GDP so that the relative burden of teacher salaries (measured as a fraction of per capita GDP) increased.[6] But even before the transition, Donaldson (1992: p. 147) had noted that '...the constraint at work ... is not (only) finance, but the limited real resources available to the economy. Competent teachers, nurses, doctors and community workers are scarce, as is the capacity to produce books, medical supplies, and building materials. So the growth and improved distribution of social services must be viewed as the growth and improved distribution of the inputs required for delivering these services.'

Inter- and intra-provincial fiscal redistribution after the transition targeted education spending much better at the poor (see Van der Berg, 2000). An analysis of Western Cape data showed that the limited remaining fiscal inequalities between schools largely resulted from differences in qualifications and experience of teachers (Fiske and Ladd, 2004: p. 124, Table 6-6). Table 9 shows complete equalisation of the pupil/teacher ratio in Western Cape schools by 2002, across former departments and also by school poverty quintile (arranged by economic status of their neighbourhood), but with major differentials in teacher quality. Nationally, teachers paid by the state increased from 24 to 31 per 1000 students in formerly black schools, and decreased from 59 to 31 in formerly white schools. Private funding allowed richer schools to supplement teaching resources from parental fees; formerly white schools on average had another 12 teachers per 1000 students paid for by parents through the school governing body, thus overall there was a reduction in teacher numbers from 59 to 43 per 1000 pupils in formerly white schools. Surprisingly, however, these large changes had little effect on relative performance in these two groups of schools.

This massive shift in teacher resources took place without major conflict and flight of the more affluent into private schools. The 3% of children in private schools remains small compared with almost one-third in many Latin American countries, which face similar

[6] Lee and Barro (1997: pp. 17–18) provide some international evidence of the relative decline of teachers' salaries: 'The ratios of estimated real salaries of primary school teachers to per capita GDP have typically declined over time; from 1965 to 1990, the value dropped from 2.5 to 2.2 in the OECD, from 4.9 to 3.6 in the overall group of developing countries, and from 7.4 to 1.7 in the (centrally planned economies).'

Table 9: *Some Indicators of Performance, Resources and Teacher Qualification by Former Department and Poverty Quintile, Western Cape 2002*

	DET	HOR	HOD	CED	Q1	Q2	Q3	Q4	Q5	Total
Number writing matric	5,415	17,363	296	12,550	7,229	7,091	7,181	7,040	7,083	35,624
Matric aggregate	823	919	1,097	1,289	844	891	997	1,192	1,264	1,037
Matric aggregate (%)	39	44	52	61	40	42	47	57	60	49
Pass rate (%)	68	83	94	99	71	81	88	94	97	86
School fees p.a.	R122	R221	R340	R2,369	R129	R244	R424	R1,623	R2,576	R1,033
Poverty rate (%)	47	31	28	18	47	38	29	22	14	29
REQV Index	13.91	14.09	14.14	14.51	13.95	14.05	14.18	14.40	14.48	14.21
Teachers per 1000 pupils by qualification of teachers										
REQV17	0.09	0.17	0.14	0.81	0.12	0.24	0.17	0.76	0.66	0.39
REQV16	0.95	1.60	2.24	3.35	1.08	1.29	2.06	2.96	3.24	2.12
REQV15	5.49	5.49	6.64	8.03	5.47	5.00	6.28	7.21	8.03	6.39
REQV14	14.07	15.86	16.70	17.37	14.57	16.70	15.89	16.54	16.97	16.13
REQV13	8.54	6.07	3.82	1.26	8.13	6.31	4.81	2.84	1.48	4.73
REQV12	0.43	0.14	0.00	0.03	0.36	0.11	0.08	0.13	0.04	0.14
REQV11	0.01	0.03	0.00	0.00	0.02	0.00	0.05	0.01	0.01	0.02

(*continued on next page*)

Table 9: *Continued*

	DET	HOR	HOD	CED	Q1	Q2	Q3	Q4	Q5	Total
REQV10	0.19	0.06	0.86	0.05	0.14	0.10	0.08	0.03	0.05	0.08
Qualifications unknown	0.65	0.56	0.62	0.50	0.61	0.55	0.49	0.53	0.58	0.55
REQV 14 or higher	20.6	23.12	25.72	29.56	21.24	23.23	24.4	27.47	28.9	25.03
Total: Publicly appointed teachers	30.41	29.98	31.01	31.40	30.50	30.31	29.91	31.00	31.07	30.55
SGB appointed teachers	0.07	1.12	0.99	11.61	0.21	1.26	2.58	7.85	11.52	4.66
Total: All teachers	30.48	31.10	32.00	43.01	30.71	31.57	32.49	38.85	42.59	35.21

Note: DET (Department of Education and Training), HOR (House of Representatives), HOD (House of Delegates) and CED (Cape Education Department). These were the former departments dealing with blacks, coloured, Indian and whites, respectively, in the apartheid era in the Western Cape. Q1–Q5 are the poverty quintiles of schools, derived from the socio-economic status of the area surrounding the schools. REQV10 is a qualification of matric or equivalent; each additional unit increase implies one more year of tertiary education, with REQV17 being a doctorate or equivalent.

equity and quality problems. Retaining most children in public schools also prevented the flight of scarce qualified teachers to private schools. An important decision here was to continue to allow schools to charge school fees, which allowed more affluent communities to supplement school resources.

Despite the fiscal resource shifts, there were still stark differences in teacher qualifications between more and less privileged schools, e.g., almost 30 teachers with a REQV of 14 or above—the supposed minimum desired qualification for secondary schools, viz. 4 years of post-matric education—per 1000 pupils in formerly white schools versus only 21 in former black schools. The absence of enough qualified teachers remains one of the most intractable problems in overcoming apartheid legacies, as this limits the potential impact of resource shifts to poorer schools. For a good overview of the teacher supply issue in the presence also of AIDS, refer to Simkins (2002).

Personnel spending is very dominant, thus even a small shift towards non-personnel spending would considerably improve availability of complementary classroom resources. These may in any event provide the highest marginal return to further investment, as Filmer and Pritchett (1999) argued. Jansen (2005: p. 75) also contends that textbooks may be particularly useful in empowering both pupils and weak teachers:

> 'Textbooks serve two functions in developing countries. First, they provide learners with substantive learning content to complement and even compensate for the weak knowledge base of teachers. Second . . . textbooks provide under-qualified or less than competent teachers with reliable and accessible learning content to guide, inform and even correct their teaching. The combination of incompetent teachers and the non-availability of textbooks holds dire consequences for teacher preparation and student achievement. . .'

After the transition, teacher unions used their strong bargaining power to raise real salaries substantially, crowding out other educational spending. From 1995–6 to 1997–8, personnel expenditure increased by 20% in real terms, while non-personnel expenditure declined by 17% (South Africa, Budget Office, 1998: p. 27). Thus increased non-personnel spending appears warranted. However, the clearest need now is to utilise existing resources better. This was already partly acknowledged by 1996 with the launch of the COLTS (Culture of Learning, Teaching, and Service) campaign, '. . .the first

more or less official recognition of the fact that efficiency and work effort problems, rather than funding by itself, were at the heart of the problems in the education sector' (South Africa, Budget Office, 1998: p. 35).

School level inefficiencies often result from a principal-agent problem. Outputs of the educational system are extremely complex to monitor, as is teacher effort (input). The educational authorities did attempt to shift monitoring to the parent community as the final 'principal', but this was hard where parents themselves had little formal education. One avenue for addressing a principal-agent problem is through providing more information. The education authorities have a paucity of information for decision making. Identifying under-performing schools in order to take remedial action requires understanding school performance. Educational policy improvements need evidence on what works and what does not, and '*(d)eveloping such evidence means that regular high quality information about student outcomes must be generated*.' (Hanushek, 2002a: p. 36). The Department of Education acknowledged this in a recent report and consequently undertook to:

> '- Invest in a system that integrates existing performance data from schools and produces performance scores specific to the country, provinces, sub-provincial units down to the district/circuit, and poverty quintiles. . . .
>
> - Research input-output trends in South African schools (as part of the research into production functions) and in other, similar schooling systems in order to arrive at normative scores that can be used to gauge the performance success of schools with varying levels of resourcing, and varying levels of socio-economic disadvantage.
>
> - Produce comprehensive and user-friendly statistics for public consumption that will allow comparisons between provinces and districts/circuits in terms of learner performance. Both absolute scores and scores that factor out socio-economic variations should be provided. Normative scores that will allow the public to assess where the schooling system is functioning best, and worst, should also be made available. Public dissemination of this information will be aimed at producing constructive debate and pressures, and will begin during 2004.' (South Africa, Department of Education, 2003a)

This would certainly increase openness and information. Teachers, schools and education departments currently have limited

accountability to parents and communities for ensuring education quality, while parents and society have little information about the effectiveness of specific schools. Systematic availability of such information would increase pressures for weaker schools to bring their performance more closely into line with better-performing schools. The poor information is illustrated by the fact that not even matriculation results have hitherto been analysed properly in a multivariate framework by the education authorities. Literacy and numeracy levels are already far below expectations at early ages, where there is hardly any measurement of quality. According to Moloi (2005), most pupils at Grade 6 level performed at Grade 3 level or worse in Mathematics tests. So the problem may require intervention much before matric. But evaluating the appropriateness of alternative interventions requires proper investigation of the data, and the availability of such data.

5. Conclusion

Improving black education is crucial to reducing the racial earnings gap. Educational access is now almost universal and racial gaps in educational attainment (years of education completed) have also been substantially reduced. The major cause for concern now lies in severe problems with the quality of education of many schools. Only limited scope remains for additional resource outlays or resource shifts to redress this. Moreover, the evidence presented supports the view that providing more resources to poor schools has thus far little improved educational performance.

Robust economic growth may reduce poverty and racial inequality in coming decades. But from the perspective of distribution—and even as a growth factor itself—an improvement in the quality of education of South Africa's poor is likely to be highly rewarding. This requires urgent attention to the functioning of poorly performing schools, to permit continued upward mobility of the largest part of the workforce as well as to support sustained economic growth.

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