Apartheid's enduring legacy: Inequalities in education

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> *"While technology no longer respects national boundaries, physical and human capital are relatively tightly bound to particular places. Workers do move across national borders, so does money and credit, and companies set up operations abroad as well as at home, but to a considerable extent physical investment within a nation and the worker skills at hand are determined by its own investments." [Nelson 1992:46]*

1. Introduction

Apartheid left South Africa with high levels of inequality, none more enduring than in education. Simkins (1998: 4) refers to such extreme human capital differentials as one of apartheid's "footprints in the sand of poverty and inequality…" Inequality in highly unequal middle-income countries often relates to the difference between the top decile and the rest: per capita income of the richest decile exceeds that of the second richest decile by 60% in the USA, by 160% in Latin America and by 208% in South Africa[1], and as in Latin America this gap, "*reflects the ... slow and unequal progress in improving the level and quality of schooling*" (Inter-American Development Bank 1998: 2).

Although South African inequality is strongly rooted in the labour market, labour market race discrimination as cause of earnings inequality has declined compared to other factors also often correlated with race, such as education, location, and household size and composition. Moreover, considerable variations in educational quality may account for much of the residual earnings differentials usually ascribed to labour market discrimination. This accentuates the importance of education (in both quantitative and qualitative terms) in long run generation of inequality.

The new government inherited a situation of large-scale educational inequality whose effects are likely to remain pervasive for decades. Understandably, education has received much attention in terms of policy experiments and government resource allocation. The school system is perceived to be the vehicle for transforming a greatly unequal society into a more egalitarian one, and it is against this objective that educational progress in South Africa should be measured. For this reason, and also because school education acts as constraint on expanding the supply of tertiary education and training, the focus in this paper falls on school education.

The intention of this paper is largely to provide an overview of the educational situation in South Africa in the decade after the political transition, with the focus on

[1] Based on 1995 data on expenditure rather than income.

economic dimensions of education. For this purpose, the largest part of the paper provides an overview of the broad educational situation and also the policies followed, often drawing on the author's own previous work, with the empirical contribution confined to a production function analysis of educational outcomes. The paper accordingly proceeds as follows: The relationship between education and economic outcomes (growth, earnings and inequality) is first briefly investigated (Section 2). Section 3 addresses the South African educational context, in terms of inequality in educational attainment and quality. An overview of educational inequality in Section 3.1 shows that quantitative educational attainment differentials have been substantially reduced, but Section 3.2 shows that quality differentials are more enduring. Section 3.3 touches on sources of inequality other than race, including some evidence of growing educational stratification amongst blacks as the better educated forge ahead of their poorer counterparts. Section 4 analyses school performance and its determinants, using both regression and regression tree analysis, and Section 5 provides a brief economic perspective on school education policy and also presents some policy recommendations. Section 6 concludes.

With regards to schooling, a case will be made that the school system contributes insufficiently to supporting upward mobility of poor children in the labour market, mainly 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 explanatory factor in determining matriculation pass rates, along with socio-economic background. 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: 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. The conclusions are alarming in that they show that quality differentials between schools are large and enduring, that fiscal resource shifts on their own have thus far had very little impact in reducing these differentials, and that there are real impediments to overcoming these qualitative differences in school performance.

2. Education, skills and economic outcomes

2.1 Education and economic growth

The relationship between education and economic growth is not as simple as many presume. For instance, if education were the crucial determinant of economic growth, England would not have industrialised before its European competitors. Moreover, empirical measurement does not provide clear answers: more developed countries generally have more educated populations, but the direction of causality (from growth to education or vice versa) is not always clear. Will the US grow faster if its poor are better educated? Will very poor countries be able to grow rapidly purely by enhancing the educational levels of their populations? There are no simple answers to such questions.

Solow's neo-classical growth model was interpreted as forecasting unconditional convergence of per capita incomes between rich and poor countries (Fagerberg 1994). The growing gap that arose instead between the "convergence club" – countries able to benefit from international capital movements and technology and indeed converging on the world leader – and most of the developing world (Baumol *et al*. 1989) called for an alternative view. Endogenous growth theory provided the new theoretical underpinnings for attaching high importance to human capital and technology as factors in economic growth. This renewed attention to growth spawned a new array of empirical studies attempting to isolate the crucial variables driving growth. Such attempts, mainly based on cross sectional data, have been relatively unsuccessful, *inter alia* because of suspect data and the difficulties in specifying or measuring human capital and technology variables: *"...the economic impact of better education is not easy to measure. Education is correlated with intelligence and family background, and its quality varies a good deal from country to country, so that it would be hazardous to assume that the quality of labour input rises pari passu with levels of education. Indeed all assumptions about the average contribution of education to growth must be very rough."* (Maddison 1989:77-8) Thus it is not surprising that Levine & Renelt's (1992) much earlier conclusion still largely applies, that international growth regressions have been unable to convincingly identify any other contributor to long term growth but capital accumulation. In particular, there is no unambiguous indication that growth is always stimulated by education, although initial education levels may influence conditional convergence of per capita output.

Most economists seem to ascribe this failure to prove the causal role of human capital in long term economic growth to data deficiencies and measurement issues rather than to the absence of a causal relationship flowing from human capital to growth. (There is also no doubting some reverse causality as well, which complicates empirical analysis.) Three forms of education-growth relationships have been tested with varying degrees of success:

- That improvements in education and in economic performance (growth) go together (which accentuates the difficulty of determining direction of causality);
- That good education is a precondition for higher growth, so that high initial levels of education lead to high rates of economic growth, all other things being equal;
- That the initial *distribution* of education, like that of other productive assets (land or capital), is crucial for growth.

A more general explanation is that human capital is a crucial ingredient of "social capability", which determines whether countries are able to attract international investment or utilise available technology to reduce the gap between themselves and developed countries (Abromovitz 1989). Social capability also incorporates factors such as institutions and governance along with human capital.

The problem in taking the work in this field further remains the paucity of dependable data where the human capital variable is specified in a form that accords with the theoretical point of departure (Pritchett 1996). Much of the empirical work has used (usually gross) school enrolment as a proxy for human capital, which it is not; almost all studies had to ignore quality differentials in education; studies differ in whether they use primary, secondary or tertiary education, or combinations thereof, in their model specifications. Only recently have some (e.g. Lee & Barro 1997) painstakingly

started collecting the data necessary for moving beyond the present empirical impasse in this field.

In one investigation of international growth performance, Baumol et al. (1989) found evidence that education played an important role, and particularly *"...when the education variable employed was that related to secondary education rather than to primary or higher education. In other words, the calculation firmly supported Professor Lewis's thesis ... that education does matter a good deal for a nation's economic growth, and that what matters most is the share of the population with secondary education."* [Baumol et al. 1989: 206]. As they note, *"In particular, it suggests that the skills and abilities transmitted in high schools are more closely related to the skills that are required for acquisition and utilization of new technology than those taught in primary school."* [Baumol et al. 1989: 353, Appendix to Chapter 9]. This introduces a useful distinction, that between *general* education, which does not provide directly relevant skills for production, but often lays the foundation for such skills acquisition, and *specific* education or training, which is usually linked more directly to the production process. This paper confines itself to the former.

2.2 The skills constraint

If it cannot be shown that education *causes* economic growth, an alternative formulation of the hypothesis is less controversial: *lack* of education or skills could sometimes *prevent* or *constrain* economic growth.

The demand for education derives from the demands of the economy for productive, skilled workers. Some education is a prerequisite for the acquisition of certain skills, though the educational system usually provides general skills rather than the specific skills required in the workplace. The demand for skills, in turn, depends on the level of economic development and therefore on economic growth, and also on the skill intensity of production. More skill intensive production processes usually accompany increased sophistication of production. International experience indeed points to a growing demand for skills. Without an acceleration in the supply of skills, educational wage premia are likely to remain high. In the USA, only an enormous expansion in secondary schooling after 1910 made possible a reduction in the returns to education until the 1950s, after which time returns again rose as skills demand outstripped supply because of "skill-biased technological change" (Goldin & Katz 1999: 25; for more recent evidence, see also Murphy & Welch 1994). Bhorat & Hodge (1999) have shown that South African labour demand patterns also reflect a growing demand for higher skilled labour and a declining demand for low-skilled workers. This also accords with the convex returns to education identified by Kesswell and Poswell (2002). Thus reducing labour market inequality requires a substantial improvement in the supply of skills.

Relatively low economic growth rates in the past decades may have prevented skills from acting as a binding constraint on growth, unlike in the 1960s and early 1970s, when rapid economic growth and limitations on black job advancement created such a binding growth constraint. The removal of job reservation, slower economic growth and a greater output of matriculants than in these decades changed this situation and the skills constraint appears not to be binding at present. This is true despite the fact that many matriculants require specific skills and training for the labour market, and in some cases their subject choice at schools (e.g. no background in Mathematics or

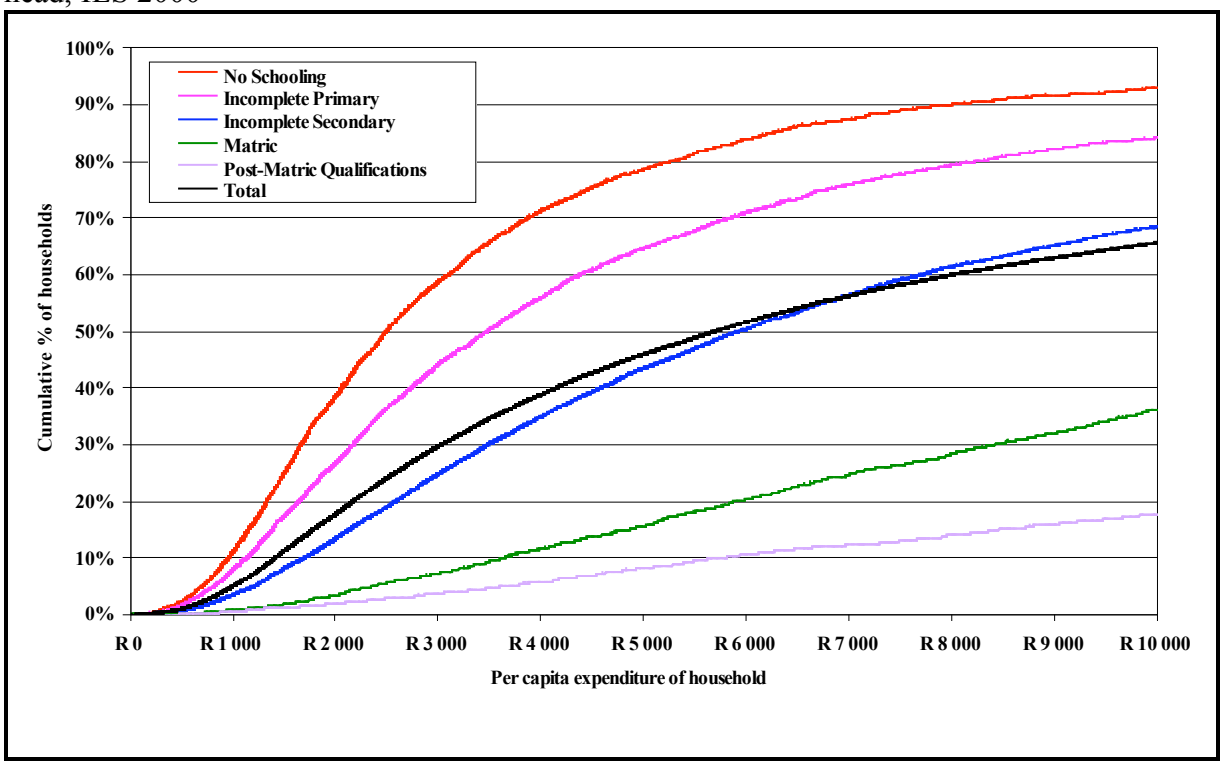
Science) make them less suitable for further training to meet labour market skills requirements. South Africa in recent years lost large numbers of people to emigration, particularly young white graduates, often because of uncertainty about job prospects in the light of affirmative action policies in the labour market. Higher economic growth as presently experienced might lead many of these individuals to return, thus ameliorating the skills constraint.

2.3 Education and earnings inequality

As referred to above, educational differentials in association with the demand for labour determine returns to education in the labour market, with wage differentials often widening as the need for more skilled workers grows, making skills acquisition more lucrative. In a macroeconomic environment generating insufficient productive jobs, the educational attainment of labour market participants largely determine who get these jobs. Bhorat and Leibbrandt (2001) show that education affects the propensity of blacks to participate in the labour force, the probability of their being employed, as well as the earnings of those who are employed, with the returns to secondary education being particularly high. Other recent work on earnings functions broadly confirms the importance of education for black earnings (Moll 2000; Mwabu & Schultz 1996; Fallon & Lucas 1998; Hofmeyr & Lucas 1998).

Education's impact on inequality also works through labour force participation and employment. About 15% of 2000 South African household per capita income differentials can be ascribed to the educational attainment of the household head alone, a far greater proportion than explained by any other characteristic of the household, although less than the one-quarter to one-third observed in Chile (Ferreira and Litchfield 1998: 32). Figure 1 shows cumulative density curves of household per capita expenditure by education of the household head for 2000. The higher the curve, the greater the proportion of the population that is poor at any given per capita income level. In most cases there is clear poverty dominance (i.e. poverty rankings remain unchanged irrespective of the poverty line), implying that being a member of household with a better educated head is associated with lower household level poverty. This is despite not controlling for other factors (e.g. race, location, household size and composition, and education and labour market status of other household members) that complicate the relationship. The lack of poverty dominance between those with some secondary education versus those with a matric only can perhaps be because of the failure to control for these other factors.

Figure 1: Cumulative density curves of per capita earnings by education of household head, IES 2000



Considering educational quality differentials (see Section 3.2 below), racial wage differentials for persons with similar education and experience may result less from labour market discrimination than from pre-labour market discrimination (i.e. in the school system) evident in school quality. As early as 1989, black wages were barely 15 per cent lower than those of whites in a similar job grade and of the same gender, a substantial reduction in discrimination compared to the 43 per cent differential of 1976 (McGrath 1990:97). Using other data sources, Moll (2000) also found that total discrimination fell from 20% of the black wage in 1980 to 12% in 1993. This trend in combination with affirmative action policies that favour educated blacks may now have largely eliminated labour market discrimination for new entrants to the labour market, although Burger and Jafta 2005 find less evidence of that, but pervasive quality differentials in education make it difficult to draw hard conclusions.

Whilst earnings inequality *between* race groups decreased between 1981 and 1993, it increased *within* race groups (Moll 2000). Improved black educational attainment probably played only a minor role compared to the removal of labour market discrimination that allowed some blacks new opportunities for upward occupational mobility while less-educated whites lost the protection they had historically enjoyed. Thus even though education was not *directly* responsible for changes in earnings, its distribution determined who were the winners and losers from the new labour market opportunities for blacks.

3. The education and skills context

3.1 Educational attainment

The legacy of apartheid education, with racially segregated schools and under-resourcing of black schools, is still evident in large differentials between white and black levels of education. A less obvious but perhaps even greater impact of the apartheid education system was on educational quality differentials which are not reflected in attainment figures and skills levels. This issue will receive attention in Section 3.2 below.

Census and survey data show that quantitative educational attainment differentials (in years of education completed) are still large, but have been substantially reduced even in the apartheid era (Van der Berg, Louw & Yu. Based on 1970 and 2001 census data, the black cohort born in 1920 had 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 (although some may still be in the education system) only 2.3 years less. Table 1, using Labour Force Survey data, shows both an improvement in overall attainment and a reduction in attainment inequality by race, gender and location.

Table 1: Educational attainment (years of education completed) of adult population (older than 20 years) by race, location and gender, 2002

	Urban	Rural	Male	Female	Total
Black	8.8	6.5	7.9	7.5	**7.7**
Coloured	8.9	5.7	8.5	8.3	**8.4**
Indian	10.6	11.1	11.1	10.1	**10.6**
White	12.2	12.0	12.4	12.0	**12.2**
All groups	**9.6**	**6.7**	**8.7**	**8.3**	**8.5**

Source: Calculated from *Labour Force Survey 5*, September 2002

Inequality in educational attainment has declined both within and between race groups. High levels of inequality in educational attainment are likely to give rise to large earnings inequalities. However, as Table 2 shows for two cohorts separated by 30 years, not only did the mean educational attainment level rise and the coefficient of variation decline, but the variance declined even amongst blacks.[2]

[2] Lam (1999) discusses the significance of this finding. As the earnings function literature shows found that eranings 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 = σ/μ (standard deviation divided by mean), which is mean-invariant, then *greater earnings inequality is possible despite reduced schooling inequality*.

Lam shows that in Brazil the standard deviation for schooling indeed rose less than the mean for cohorts born 1925 to 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 is unlike the case in South Africa.

Table 2: Inequality in educational attainment for two SA cohorts, 2002

	Total population		Black population	
	Cohorts aged 55-59	Cohorts aged 25-29	Cohorts aged 55-59	Cohorts aged 25-29
Mean	6.82	9.99	4.92	9.69
Standard deviation	4.61	3.74	3.96	3.93
Coefficient of variation	0.68	0.37	0.80	0.41

Source: Calculated from *Labour Force Survey 5*, September 2002; cf. also Lam 1999: Table 2

Although behind most middle-income countries in terms of educational attainment, South Africa made good progress in the 1960s to 1980s.[3] Despite apartheid, black education 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 the persistence in low school completion rates is linked to educational quality. What is notable is perseverance of many overage blacks enrolled at school, perhaps due to their perceptions of the poor labour market prospects for people with low educational attainment. In recent years this phenomenon induced the Department of Education to bar over-age youths (over 20) from the schooling system.

Though the white population has educational levels similar to those for developed countries, the racial distribution of education (upper panel in Table 3) shows the backlogs still plaguing other groups. Altogether 69.8% of whites above age 26 (when most individuals are no longer engaged in full time education) had completed matric or more; 14.5% had a degree. In comparison, only 18.5% of blacks over 26 years had completed matric or more, and only 1.4% had graduated. Despite these inequalities, the dramatic expansion of primary education in the 1960s, and of secondary education in the 1970s and 1980s, has unalterably changed the educational profile of the labour force. For younger cohorts of blacks the educational lag behind whites has narrowed considerably. The bottom panel of Table 3 shows that amongst the black cohort aged 26-30, the proportion with at least matric has risen to 36.2%, whilst the improvement in this youngest cohort of the adult population for the total population is dramatic: 41.0% had completed at least matric.[4] But note that the number of university graduates has not yet shown improvement – educational expansion has been largely confined to the school system, in part because poor quality of matric passes limited university exemptions.

[3] Cf. Lam (1999) for a comparison with the much weaker progress in Brazil. This is perhaps not all that surprising: Filmer and Pritchett (1998) found that Latin American educational inequality was larger even than in many countries of Southern and Eastern Africa (though South Africa was excluded from their sample), and Londoño (1996) confirms that Latin American educational attainment lags far behind most other countries at this level of economic development.

[4] Census and survey estimates may sometimes exaggerate the number of individuals who have completed matric. Many respondents who have attempted but failed matric (a still far too common occurrence) specify matric as their highest level of education completed.

Table 3: Educational profile of the SA population by race for two age groups, Census 2001

	Black	Coloured	Indian	White	Total
Population aged 26 or more:					
No schooling	26.45%	9.48%	6.05%	1.26%	20.83%
Primary incomplete	20.85%	20.57%	8.82%	1.17%	17.81%
Primary complete	7.44%	10.47%	4.76%	0.73%	6.74%
Secondary incomplete	26.72%	40.16%	36.03%	26.99%	28.31%
Matric	13.29%	14.54%	30.17%	39.55%	17.46%
Matric + Cert./Dip.	3.81%	3.41%	7.32%	15.78%	5.49%
Bachelor's Degree or above	1.44%	1.39%	6.85%	14.51%	3.36%
Total	**100.00%**	**100.00%**	**100.00%**	**100.00%**	**100.00%**
Population aged 26-30:					
No schooling	10.94%	3.61%	1.49%	0.77%	9.16%
Primary incomplete	12.40%	12.21%	1.44%	0.63%	11.07%
Primary complete	5.87%	7.86%	1.11%	0.34%	5.45%
Secondary incomplete	34.61%	41.28%	22.70%	16.37%	33.32%
Matric	28.46%	28.68%	50.87%	46.24%	30.62%
Matric + Cert./Dip.	5.99%	4.61%	12.75%	19.34%	7.19%
Bachelor's Degree or above	1.73%	1.73%	9.63%	16.31%	3.19%
Total	**100.00%**	**100.00%**	**100.00%**	**100.00%**	**100.00%**

Source: Derived from Census 2001

The SA education system has shown much improvement in delivering numbers of matriculants compared to, say, the situation in the early 1970s. In 1970, only 43 000 people matriculated; in 1990, 191 000 did, and in 2003, 322 000 did. The growth rate of the number of matriculants of 7.8% per year in the period 1970 to 1990 thus dropped to a still respectable 4.1% per year in the next thirteen years. However, this average hides the fact that the annual rate did slow in the immediate post-transition period and only recovered in the last four years. Disturbingly, 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 – a considerable achievement – but thereafter growth decelerated to a paltry 2.4% per year (even below the economic growth rate) to arrive at some 82 000 exemptions in 2003.

3.2 Educational quality

The old dividing lines of race have blurred with many black pupils now attending formerly white schools[5], but there is great variation in *quality* amongst mainly black schools, which generally still perform much weaker than formerly white schools. Judging by the high matriculation failure rates, promotion to higher standards appears

[5] Data for 1997 for 7 provinces (all but Mpumalanga and Eastern Cape) showed that about 22 000, or 5.4%, of the 400 000 pupils in mainly white schools (defined as those with more than 70% white pupils) were blacks, whilst in "mixed" schools (were 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. Indian schools had the greatest penetration by blacks: 15 000 or 15.2% were black pupils. Nevertheless, most black pupils (95.8%) were still in schools that were predominantly black at that time (Own calculations from Department of Education data.)

to be relatively easy, thus educational attainment (years of education completed) may exaggerate progress in cognitive levels mastered.

Taylor et. al. (2003: 41) summarized some evidence on educational quality as follows: *"Studies conducted in South Africa from 1998 to 2002 suggest that learners' scores are far below of 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 (Van der Berg, Wood & Le Roux 2001; Fuller *et al.* 1995). 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. Keeping all other factors constant, Case and Deaton's (1999, Table 8) regressions results indicate that these black teenagers had a backlog equivalent to almost 10 years of completed education. This illustrates the inability of black schools to provide the educational quality required for a modern economy. Quality also varied systematically by race and socio-economic status.
- In the Grade 8 Mathematics and Science Study (TIMSS-R) study, South Africa's scored 275 for Mathematics compared to a mean score of 487 for all 38 participating countries, and for Science section 243 compared to the average of 488 (Taylor et al. 2003).
- The MLA (Monitoring Learning Achievement) study, undertaken in 1995, found that South African grade 4 pupils scored by far the worst of twelve African countries in terms of numeracy, its score of 30% being well below that of the second lowest country. In literacy South Africa outperformed only 3 of the 12 countries.
- Surveys of Southern African Consortium for Monitoring Educational Quality, known as SACMEQ II, were conducted in 14 countries of Southern Africa in 2000 and the results are summarized in Table 4. South Africa's performance at the Grade 6 level was substantially below many of the other countries in this region – In fact, in the bottom half of the fourteen countries on both reading comprehension and mathematics. South Africa's high standard deviation indicates high inequality in performance, and the intraclass correlation coefficient, rho (the proportion of variance between individuals that occurs between rather than within schools), was very high and by far the highest in this group of countries (Van der Berg 2005). A government report (South Africa, Department of Education 2003a: 102) Education notes that the weak South African performance occurs despite much higher South African expenditure per pupil. Surprisingly, also, despite its greater fiscal resources, South Africa lags many countries in the region in availability of text books, particularly in Mathematics.
- The Systemic Evaluation of 54 000 Grade 3 pupils indicated serious shortcomings in education quality. For life 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: viii-ix). Here too there were great inequalities.

Table 4: Mean score, score 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 (countries arranged by mean score)				MATHEMATICS (countries 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

Quality differentials are also reflected in the quality of the matriculation itself, in terms of the standard at which matric is passed as well as the subject choice. Tables 5 and 6 show that the number of candidates who wrote Mathematics at the Higher Grade almost halved between 1997 and 2001. Partly as a consequence, the percentage of candidates who passed increased from one third to 56%. Worryingly, however, only 15.5% of all black candidates for Mathematics at the Higher Grades passed this exam – in all, only just over 3000 pupils. As a good performance in Mathematics at the Higher Grade is usually a requirement for tertiary study in the Natural Sciences, Engineering and Commerce, this is particularly disturbing. Even at the Standard Grade, the success rate for blacks was lower than the national average, at 23% versus 32%. Disturbingly, only 4.6% of all matriculants passed Mathematics at the Higher Grade in 2002, whereas another 23% passed it at the Standard Grade. As can be seen from Tables 5, the performance of black students in Physical Science is as perturbing as that in Mathematics. Overall only 27% of all pupils passed Mathematics at some level in 2002, while fewer than 22% of students passed Physical Science. Only 50% and 42% of teachers teaching Mathematics and Science respectively have studied these subjects beyond secondary school level (Edusource 1999: 5).

Table 5: 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	% of can-didates	% of all matricu-lants	Wrote	Pass	% of can-didates	% of all matricu-lants	Pass	% of all matricu-lants
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: Black	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: Black	33 657	5 136	15.3%	..	77 680	32 874	42.3%	..	38 010	..

Source: South Africa, Dept 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 & 4.19

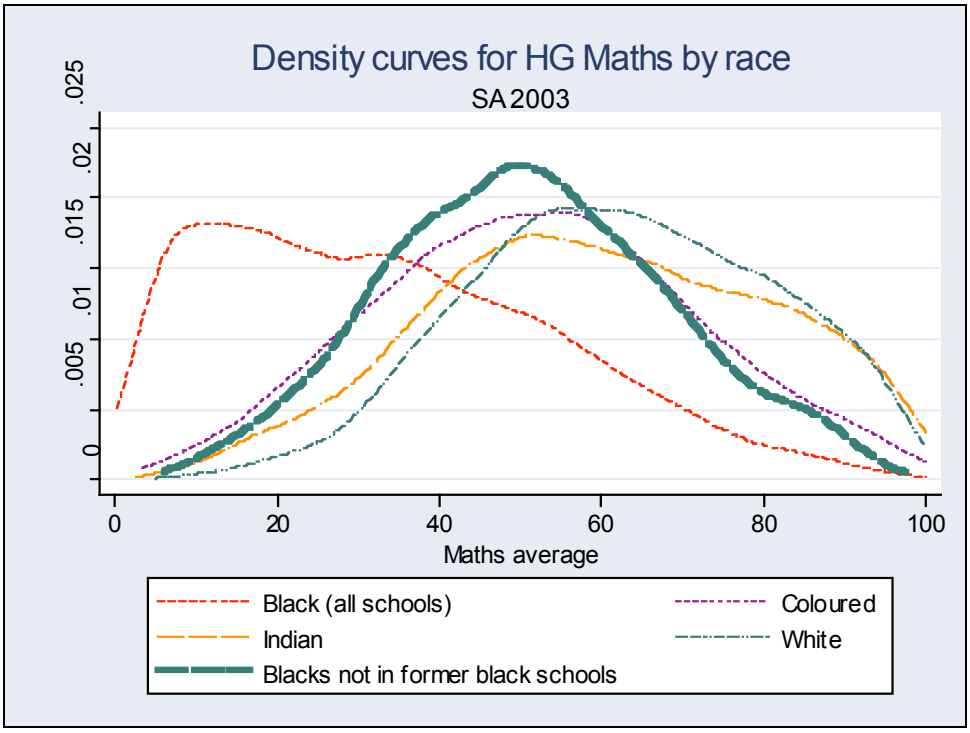
Table 6: Mathematics and Physical Science passes by level of pass and by province as % of all students who wrote matric, 2002

	Eastern Cape	Free State	Gauteng	Kwazulu-Natal	Limpopo	Mpuma-langa	Northern Cape	North West	Western Cape	TOTAL
Mathematics passes:										
Higher Grade	2.1%	4.7%	9.3%	4.6%	2.0%	2.3%	5.8%	2.8%	9.6%	4.6%
Standard Grade	22.9%	25.3%	29.1%	23.9%	15.8%	16.2%	25.6%	20.2%	29.7%	22.8%
Lower Grade	7.4%	5.3%	5.2%	6.9%	3.9%	4.4%	3.2%	5.2%	4.7%	5.5%
Passed Maths at some level	32.4%	35.3%	43.6%	35.4%	21.8%	23.0%	34.6%	28.2%	44.0%	33.0%
Wrote Maths	60.7%	54.0%	64.6%	68.5%	49.3%	50.2%	40.7%	55.4%	56.7%	58.8%
Science passes:										
Higher Grade	2.1%	6.3%	10.2%	6.3%	3.5%	3.2%	5.3%	3.9%	9.6%	5.6%
Standard Grade	16.4%	16.5%	20.0%	17.0%	12.0%	13.2%	15.9%	15.2%	16.0%	15.9%
Lower Grade	8.1%	4.8%	4.9%	4.9%	2.6%	5.4%	2.7%	5.8%	3.1%	4.9%
Passed Science at some level	26.6%	27.7%	35.1%	28.2%	18.1%	21.8%	23.9%	24.9%	28.8%	26.5%
Wrote Physical Science	36.8%	35.2%	41.9%	36.1%	27.8%	33.6%	25.3%	33.6%	31.2%	34.7%

Source: Derived from South Africa, National Treasury. 2003. Intergovernmental Fiscal Review 2003. *Pretoria: Tables 4.18 and 4.19*

A more recent indication of quality differentials can be found in results from the 2003 matric examination, analysed by race of individuals (the only other available variables were gender and age). Matric passes are 28% of the 19 year old cohort amongst blacks and 68% amongst whites. Almost one in ten of the white cohort achieves a matric A-aggregate in public schools, a measure of quality, versus just more than one in a thousand of the black cohort. Moreover, almost half of these successful black candidates were in schools where blacks were not in the majority in the matric class, probably indicating that they were former white or Indian schools. Figure 2 shows the results in Higher Grade Mathematics by race group. There has already been much selection in this group, as many pupils never reach matric, many elect not to do Mathematics as a subject, and of those who do, few face the Higher Grade Mathematics hurdle. As can be seen, the results of black candidates generally were dismal: the mode lay well below 20%, whilst the other race groups achieved much higher scores. Also, it is noticeable that black students in other than mainly black schools perform much better and altogether not so very different from the other groups. However, this is a relatively select group within the black population: More urban, and often they come from higher socio-economic background and have more educated parents.

Figure 2: Density curves for Higher Grade Maths by race, 2003

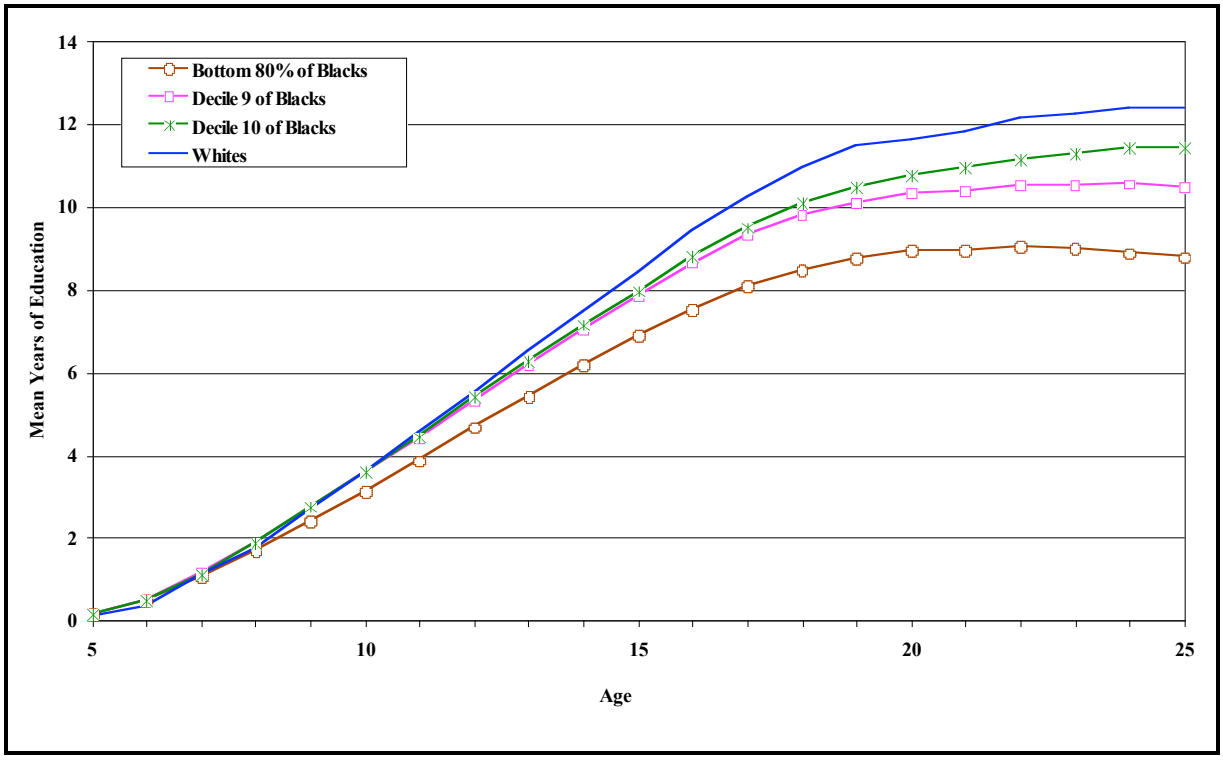


3.3 Other educational inequalities

Greater recent access to formerly white schools for more affluent blacks may have accentuated *qualitative* educational differentials amongst blacks. In some Latin American countries, where private education offers an important route to quality education, differential quality of school education are a major cause of differentials in labour market earnings of people. "*Estimates show that 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 amongst blacks largely follows socio-economic lines: more affluent families are better able to support their children through school. This link between socio-economic background and educational and therefore labour market outcomes reinforces inequality and contributes to increasing stratification within black society. Case & Deaton (1999: 21) conclude that private resources (expenditures) were a major factor in determining differential black educational outcomes under apartheid: "*Pupils in better-off Black households do better in their education, and we find no parallel for Whites. That the education of Blacks but not Whites is constrained by financial resources is further supported by the fact that many Blacks who are not in school (but not Whites) – report lack of resources as the reason*." (Case & Deaton 1999: 28). Figure 3 shows that on average children from the top two black deciles progress considerably better through the school system than their poorer counterparts, and only at about age 15 start falling behind whites.

Figure 3: Years of education by age, race and income group, Census 2001



Source: Derived from Census 2001

Generational effects are also important in education and earnings. Not only do children of more educated parents progress better in school, but they also fare better in the labour market once they leave school. Data from the 2001 census presented in Table 7 show mean earnings of relatively well-educated full-time employed young black workers still resident in their parent household to be substantially higher where the household head has matriculated: For children who have matriculated, having a parent who has also matriculated virtually doubles own earnings, whilst for children with tertiary . In some way the better education of the household head translates into higher earnings for children even compared to other young workers who also have matriculated, but where the parent had less education. Whether this finding reflects the quality of education, some other non-observed aspect of human capital transmitted from parents to children, or parent social networks is not clear.

Table 7: Mean monthly earnings of full-time employed children (aged 20-24) of head of household by education and whether head has matriculated, 2001

	Highest Education Level Passed of the children in the household	
	Matric	**Tertiary education**
Head of household matriculated	R4 512	R5 158
Head of household not matriculated	R2 262	R3 687
Premium for head being matriculated	99%	40%

Source: Derived from Census 2001.

4. Analysing school performance

4.1 Inequalities in school outcomes

The only widely available measure of school outcomes remains the results of final matric exams. As has been shown above (Section 3.2), post-transition performance in terms of the numbers of pupils passing this exam has not been particularly good, and this applies to an even greater extent to endorsements or university exemptions – a measure of quality that determines readiness for tertiary education. Despite the availability of substantially more school resources and a more equitable allocation of such resources across schools (discussed in Section 3.5), overall output of the school system has barely kept pace with population growth. Weak matriculation performance is particularly severe in the poorest provinces, which benefited most from resource increases after the political transition. There is clearly a problem in the way in which resources are used in communities where education quality is particularly deficient.

An indication of uneven school level performance is found in the data presented in Table 8. This is based on the school fees (a measure of the socio-economic status of communities) and racial composition in 1997, linked to the matriculation results for the years 1999 and 2000. We identify a school with a particular race group if more than 70% of the pupils in 1997 belonged to that race group. There are large inequalities in results between the different provinces, but even more disturbing is the massive differential between the poorest schools (with an average pass rate of 44%) and the richest schools (a pass rate of 97%). A similar differential is observed between predominantly black schools with pass rates of 43% and white schools with pass rates of 97%. To put this extremely large differential into historical context, in 1994 – the last year for which racial data were collected on matriculation pass rates – the black pass rate was 49% as against the 97% of whites. Thus there has seemingly been no improvement since in black schools, despite large resource shifts between schools, although mainly white schools now accommodate far more black pupils.

Also noteworthy is that the standard deviation of the pass rate increases further down the socio-economic ladder, indicating a more varied performance in poor schools, and particularly those that are predominantly black. Whilst pass rates in more affluent schools were almost uniformly high – amongst mainly white schools the lowest recorded pass rate was 68% –, predominantly black schools performed abysmally. Most such schools had pass rates in the range 20-60% (Table 9) and ten percent had even worse pass rates. In contrast, only 3 out of 179 mainly white schools had pass rates below 80%. Resources do matter in this regard, but differentials in efficiency amongst poor schools may be more important than those in more affluent schools. Amongst poor mainly black schools that charged school fees of less than R30 per annum, the best performing quartile had a pass rate of 68%, while the worst quartile had a pass rate of only 18%. This difference cannot be explained by the socio-economic situation of the schools, because all of these schools served largely poor black communities. Neither can these differences be accounted for by differences in teaching resources, as these were all relatively poor schools that were historically badly resourced. The difference therefore must lie in something inherent to the functioning of these schools.

Table 8: Number of schools, mean and standard deviation of average matriculation pass rates in sample by school fee group, "race type" and province

	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

Table 9: Frequency distribution of schools by "race type" and pass rate range, 1999-2000

Range of average pass rate by school	Black	Coloured	Indian	White	Mixed	Race unspe-cified	Total
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**
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%**

4.2 Explaining school performance

We now apply a production function approach to analyse school performance. Such analyses have before been carried out by only a few researchers in South Africa (Crouch and Mabogoane 1998, Van der Berg 2001a, Van der Berg and Burger 2003; Van der Berg 2005; Gustafsson 2005; Fiske & Ladd 2003 include a similar regression, but with a slightly different focus.) This approach to measuring school efficiency is similar to using a production function to model the production process. Good overviews of this production function approach to education are presented in Hanushek (2002c) and Filmer and Pritchett (1999). Essentially such an approach tries to statistically measure the relationship between inputs and outputs into the education system, holding constant other explanatory factors such as the socio-economic status of the community from which pupils are drawn, so as to determine what factors influence the performance of schools serving pupils of similar socio-economic status.

The data consist of matriculation[6] pass rates for 1999 and 2000, matched to data for seven provinces on 1997 school resources and racial composition. Matching data was sometimes impossible due to inconsistencies in identifying schools between the 1997 data set and the examination data. No matching was possible for the North West province, leaving data for only six of the nine provinces. Although the final matched sample included a large proportion of schools in each of the six provinces covered, it is not clear whether missing observations were non-random. Despite variations in sampling proportions across provinces due to problems of matching the two data sets – the Free State, Northern Cape and Limpopo were represented better than average –, we chose not to re-weight the data at the provincial level. The sample of almost 2 800 covered about half of all schools, matriculation candidates and matriculation passes nationally, and collectively represents about 70% of the total of each of these variables in the six provinces covered. Matriculation class size in sample schools was above average for these six provinces, while the 56% pass rate in the sample differed little from the actual average in these provinces (58%). Thus the results apply to a fairly but not fully representative sample of about half of all schools and matriculation candidates nationally.

The examination data set contains 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 ($r = 0.85$) indicates a large measure of stability in pass rates at the school level. The *average* pass rate over the two years was used as a performance measure to reduce the effect of year-to-year variations, especially for small schools, and the number of candidates in each school who wrote in 2000 was used to weight each observation (school). 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 school fees (average actual fees paid rather than fees set) and the level of educational resources were taken as a proxy for socio-economic status and availability of educational resources over the high school career as well as allowing for a possible lagged effect of resources on performance. In 1997, the apartheid-era resource differentials between schools had not yet been eliminated, so that our data capture some effects of the past and include a variety of resource experiences.

[6] Matriculation examinations, nationally monitored and provincially set and examined, offer the possibility of measurement across different schools, although some fear that inadequate maintenance of standards reduces the comparability of inter-temporal and indeed also cross-sectional performance.

Teacher resources were measured by pupil-teacher ratio, the average salaries of teachers (a measure of their qualifications and experience), or a combination of these two, viz. average teachers costs per pupil.

4.2.1 Regression analysis

A priori, one would expect matriculation pass rates to improve with higher school fees (which reflect pupil socio-economic status and afford schools additional resources), a lower pupil/teacher ratio, higher teacher salaries (which reflect teacher qualifications and seniority), fewer black pupils (black schools were historically worst resourced and are most likely to have ongoing problems with the culture of learning), and in historically better-endowed provinces such as Gauteng and the Western Cape (with good provincial education management, mainly metropolitan pupils, and administration which did not need to incorporate former homeland structures). Regression results are broadly consistent with these expectations, although provincial dummies are not very informative. Regression 1 in Table 10 shows that matriculation pass rates of schools were associated with pupil socio-economic background as measured by school fees, teaching resources (both the pupil/teacher ratio and the average teacher salary in a school), provincial location, and also – disturbingly – by the race category of schools. Kwazulu-Natal and the Western Cape both perform significantly better – 5 and 8 percentage points respectively – than similar schools in Limpopo, the reference province, but other provincial dummies are not significant. All other variables are highly significant and their signs as expected. A full log-transformation did not produce a better fit. The coefficient of determination is high for a cross-sectional regression of this nature – 57% of the variation in pass rates is explained by the equation. Further, tests show the results to be insensitive to the presence of outliers.

The coefficient of the dummy for mainly white schools indicates that, *holding constant the level of school fees, pupil/teacher ratios, teacher salary level and province*, a school containing mainly white pupils has a matriculation pass rate 33 percentage points higher than a similar school with mainly black pupils (black schools represent the omitted or reference value). Therefore, only 21 of the 54 percentage points difference between black and white schools could be explained away by school fees, educational resources and province: factors highly correlated with race. This is a highly disturbing but not surprising finding – a large part of the educational system appears to still be unable to overcome the ravages of apartheid education, which manifest in dysfunctional management structures and dismal functioning of black schools.

Table 10: Regressions of matriculation pass rates by school in six provinces, 1999-2000 (t-values shown below coefficients)

Dependent variable: Pass rate (average 1999 & 2000)	Regression 1: All schools	Regression 2: Mainly black schools	Regression 3: Other schools
School fees per pupil (R per annum)	.01296***	.03417***	.01144***
	12.188	9.353	12.735
Pupil/teacher ratio	-.1353***	-.1187**	-.3746***
	-3.397	-2.724	-3.360
Average teacher salary	.0004347***	.0004122***	.0009125***
	8.072	6.357	8.962
Mainly coloured school (dummy)	21.92***	-	-
	10.952		
Mainly Indian school (dummy	24.18***	-	-
	9.549		
Mixed school (dummy)	20.52***	-	-
	13.034		
Mainly white school (dummy)	32.96***	-	-
	17.584		
Race unspecified (dummy)	29.14***	-	-
	12.763		
Kwazulu-Natal (dummy)	5.36***	5.83***	-1.06
	5.425	5.137	-0.329
Free State (dummy)	-1.61	-2.72*	7.58*
	-1.317	-1.978	2.151
Northern Cape (dummy)	3.45	1.81	5.11
	1.420	0.455	1.368
Gauteng (dummy)	-.91	-1.87	1.34
	-0.852	-1.468	0.423
Western Cape (dummy)	8.42***	3.10	10.51***
	4.758	1.012	3.285
Constant	9.95*	10.50	-4.13
	2.048	1.818	-0.393
N	2 768	2 106	662
R^2	0.572	0.086	0.421
R^2-adjusted	0.567	0.082	0.414
Standard error	17.908	19.396	13.259

* indicates .10 level of significance
** indicates .01 level of significance
*** indicates .001 level of significance

Replacing school fees by their natural logarithm, implying that a proportional effect is measured, or replacing the pupil/teacher ratio and the teacher salary by a single variable (the teacher cost per pupil[7]) had little effect on the results and left the other coefficients relatively unaffected, which suggests that the underlying logic of the model is not greatly affected by the particular specification used.

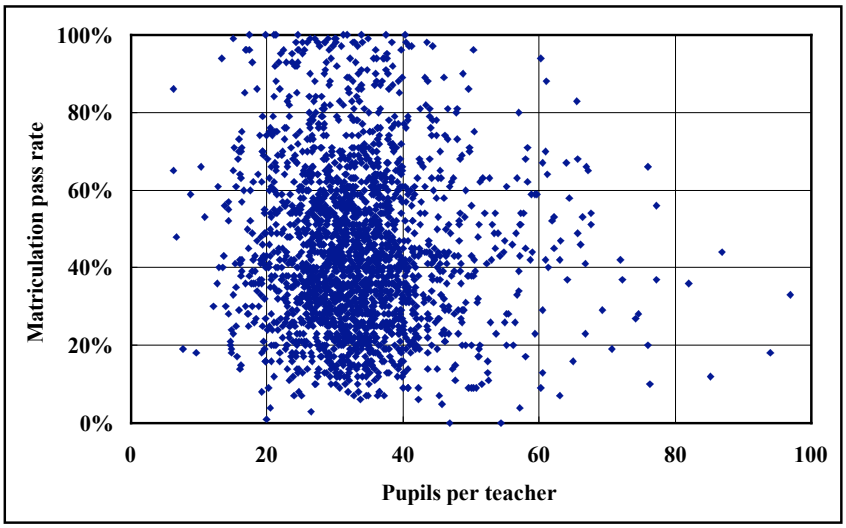
[7] The coefficient for school fees is five times as large as that for teacher cost per pupil. This implies that school fees do more than only augment fiscal resources, possibly for two reasons:

- School fees are likely to be spent more effectively than other school expenditures, being controlled by school governing bodies, who are closer to schools' real needs.
- School fees are a good proxy for economic status. Where school choice exists in practice (as in metropolitan areas or large towns), parents mostly choose the "best" school they can afford for their children. Where distance limits school choice, as in rural areas, school fees are set at a level most parents can afford. Thus school fees in both cases reflect the economic status of most parents.

However, the bimodal distribution of school pass rates points to two underlying data generation processes rather than a single one. We may better understand these processes if we were to model them separately, thus we split our initial sample into two groups and run similar regressions for these groups, viz. mainly black schools versus other schools. Both sample sizes are still healthy. Not too great reliance should be placed on comparisons of the magnitude of coefficients in a model which is not fully specified. With this caveat in mind, the results from these two regressions can be summarised as follows:

- Again, school fees and educational resources have a significantly positive influence on matriculation pass rates in both regressions.
- Surprisingly, the coefficient for school fees is almost three times as large in black schools as in other schools, pointing to strong differentiation within dominantly black parts of the school system. This accords with an interpretation that rural black schools, where communities are generally poorer, perform much worse than urban black schools, where parents are often less poor and better educated than their rural counterparts. It also accords with the finding of Case & Deaton (1999) that personal financial resources matter more for educational progress of black children than for whites.
- Also surprising is that the coefficient for the pupil/teacher ratio is much smaller in mainly black schools, where historically high pupil/teacher ratio have been regarded as particularly detrimental. These results contradict the widely held view that, on their own, resource shifts to blacks schools would improve overall educational performance, without additional attention to the efficiency of resource use in these schools. Figure 4, which shows little relationship between the 1999-2000 matriculation results and the 1997 teacher-pupil ratio for black schools, supports the conclusion that teacher-pupil ratios in isolation seem to matter little for school performance. The correlation coefficient of -0.06 means that – statistically speaking – less than 4% of the variation in matriculation pass rates amongst black schools can be explained by the pupil-teacher ratio. Even more surprisingly, the coefficient for teacher quality (as proxied by salary) is also lower for black schools.
- The coefficient of determination of 0.086 for Regression 2 indicates that the model leaves the enormous variation in pass rates in black schools largely unexplained. In striking contrast, 42% of the much smaller variation in matric results in other schools is explained by these variables.
- Kwazulu-Natal's black schools fare significantly better than expected, whilst for other categories of schools the Western Cape significantly outperforms most provinces. The Free State, interestingly, has significantly lower pass rates in its mainly black schools and higher pass rates in other schools.

Figure 4: Pupils per teacher (1997) versus matriculation pass rate (1999/2000) in black schools



Thus race or associated factors still constitute a major determinant of differential matriculation pass rates, complemented by economic status (school fees). Resources are not the major determinant of the systematically poorer performance of black schools. These results also imply that the "success" of our first regression in "explaining" variation in matriculation results was in part artificial, because it used race composition (presumably reflecting former department) as an explanatory factor, blurring the different effects which other explanatory variables had on school performance and ignoring the fact that two different data generating processes were at work in black schools compared to other schools. The question then arises: which school characteristics are captured by race composition? From discussions with people involved in managing schools, a best guess is that the differences are related to the quality of 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 could be seen as a form of managerial inefficiency that dates back to the apartheid era.

Even the large shifts in school level resources still leave mainly black schools performing much worse than white schools. This leads to the conclusion that on their own, further educational resource shifts may have a limited effect in improving educational outcomes and thereby the long term situation of blacks in the labour market. This may be because the pupils who have the greatest distance to catch up are those in rural areas, where socio-economic status – and the associated educational status of parents – is weakest, and good teachers harder to come by. Greater resource inputs alone cannot much improve this situation unless accompanied by a fundamental reorganisation in how schools function.

The quarter of black schools which exceeded the total sample's average pass rate of 56% have 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 cannot be explained by differences in resources and only to a limited extent by differences in socio-economic status. Moreover, the greatest improvement in educational

opportunities for black children probably arises for those who can afford to send their children to historically white schools or to private schools. Here too, private resources as reflected by school fees matter, but differences in public educational resources play only a small role. Again, factors associated with the functioning of the school as a productive unit rather than the availability of resources appear to be crucial to proper performance, particularly in poor communities.

Thus regression analysis supports the contention that school efficiency, and management in particular, requires most policy attention to overcome the legacies of past inequalities in education.

4.2.2 Regression tree analysis

To supplement the above analysis, this sub-section turns to a regression tree methodology (*classification trees* are used where the dependent variable is categorical). 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 (shown in the right node) and low values (the left node) 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 dependent variable – the pass rate averaged for 1999 and 2000 – to ascertain which predictor values played a role. Five potential explanatory variables were employed – the race composition of schools, school fees per child, average salary level of teachers in the school, pupil/teacher ratio, and the province in which schools were located. The first differentiating factor was found to be race type, with schools with more than 53.0% black pupils being separated in the first step from other schools (Node 1). Within these largely black schools, the predictor value that entered next was school fees per pupil: the 237 schools with fees above R70.09 did substantially better than the 1 869 mainly black schools with lower fees (Node 2). Amongst the lower of these two groups, the next predictor that played a role was teacher salaries (Node 3), with schools in this group reporting teacher salaries above R86 559 performing significantly better (Terminal Node 3). For schools in this group with lower salaries, school fees (above or below R30.29 per year) could once again provide a useful separation in performance (separating Node 4 into Terminal Nodes 1 & 2). For mainly black schools with higher school fees (Node 5), teacher salary was also an important separator (Terminal Nodes 4 & 5). Once this level of separation was reached, no further significant differentiation was observed amongst either of these two groups of schools.

For non-black schools, further differentiation did not again find race to be an important predictor. Despite vastly different histories under apartheid, there appeared to be no systematic difference amongst non-black schools ascribable to schools' race type: white, coloured, Indian, unspecified and mixed schools perform rather similarly. Instead, fees per pupil were again the main predictor (Node 6), with a level of R316.92 dividing the sample into two groups with the greatest difference in pass rate. The higher fee group (304 schools) could not be distinguished any further (Node 8). Within the lower performing group, province was still a significant predictor:

Kwazulu-Natal and the Western Cape (Node 7) performed better within this sample, and were separated from the other four provinces on this basis (Node 6).

Whilst Figure 5 shows the full regression tree analysis, Figure 6 shows the results for the terminal nodes. For each terminal node, the mean pass rate and the 95% confidence level for the pass rate is shown. Table 11 below provides a synopsis of the decomposition rules.

Figure 5: Regression tree analysis of school performance

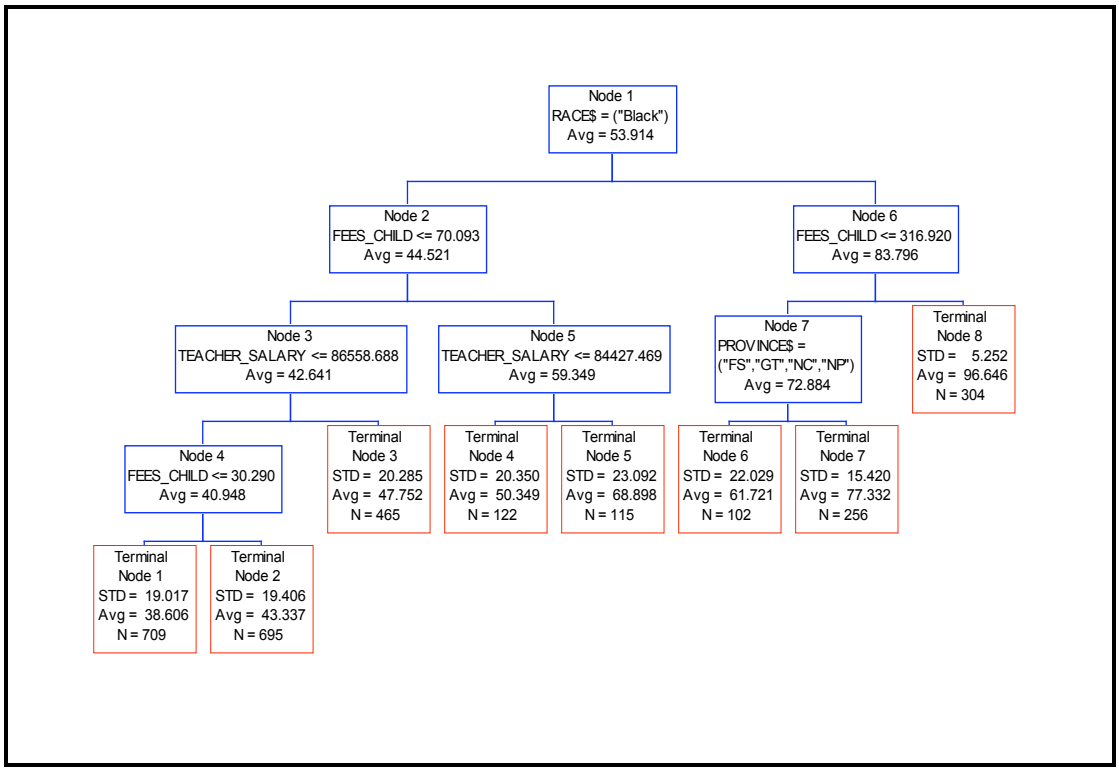
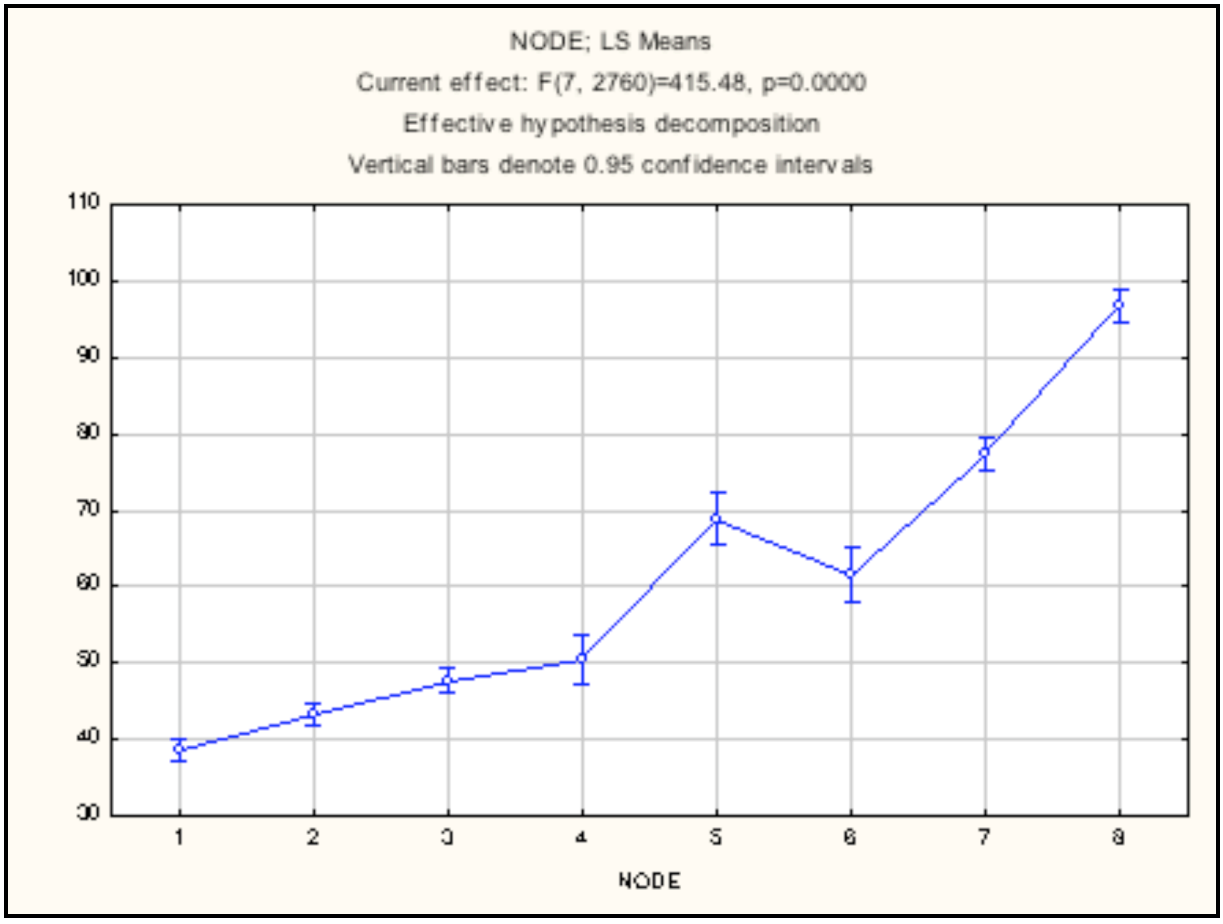


Table 11: Synopsis of decomposition rules for regression tree of school performance

Terminal Node	School race type	Teacher salaries	School fees	Province
1	Mainly black (>53.9%)	<R86 559	<R30.29	All
2			>R30.29, <R70.09	
3		>R86 559	<R70.09	
4		<R84 427	>R70.09	
5		>R84 427		
6	Not mainly black	All	<R316.92	Limpopo, Free State, Gauteng, Northern Cape
7				Western Cape, Kwazulu-Natal
8			>R316.92	All

Figure 6: Pass rates achieved for different terminal nodes in the regression tree analysis



What is striking about these results is that *the pupil/teacher ratio never emerges as a predictor variable*, not even for predominantly black schools considered separately. Amongst such schools, higher school fees are a better predictor of improved pass rates than are more teachers. Regression tree analysis thus strengthens the conclusion from regression analysis that the pupil/teacher ratio does not play a strong role in school performance, unlike teacher salaries (which proxy teacher qualifications and experience).

4.2.3 Conclusion on school performance

The bulk of the remarkably large differentials in performance amongst poor black schools cannot be accounted for by socio-economic background or teaching resources, pointing to the importance of other factors. School management and malfunctioning of large parts of the former black school system seem to be the candidates, pointing to a possible problem of x-inefficiency rather than allocative inefficiency in the failure hitherto to overcome this apartheid legacy. The regression findings raise important policy issues, for they show the important role of former department, poverty and qualified teachers in determining school performance.

The policy implication is that additional fiscal resources by themselves can make only a limited contribution to improving educational performance. An optimistic

interpretation is that addressing educational backlogs need not be costly; the pessimistic view is that good administration, management and quality teachers are even more scarce than fiscal resources, and that attempts to shift such resources to poor schools could face major obstacles. The weak socio-economic status of pupils in poor schools cannot be targeted for improvement in the short term as poverty is very difficult to overcome in a short time span. Improved management is probably the most important requirement for reducing inefficiencies in black schools, while matriculation outcomes in these schools are unlikely to improve beyond a certain level if good teachers remain in short supply. However, getting more qualified teachers and better management into poor schools is more than only a fiscal problem, as it conflates issues such as location (urban/rural and city/townships), language, race and union opposition to salary differentiation. Meeting this challenge is essential for reducing the performance gap between poor and affluent schools and achieving greater equity in educational outcomes.

5. An economic perspective on school education policy

Faced with an educational system ravaged by apartheid and that had previously enjoyed little legitimacy, the new government tackled a number of tasks simultaneously. This included reunification of the education system; deracialisation of schools (which was highly successful); focusing attention on curricula matters; and the highly contentious implementation of outcomes-based education. Unfortunately, economic perspectives played no role in this reorganisation of the system. Policy aimed at democratising education included granting more responsibility to school governing bodies (SGBs) inter alia with respect to setting school fees to supplement public resources and exercising control over the management of school funds; facilitating self-monitoring of teacher progress; and providing skills training for management and teachers. Efforts aimed at more equitable access to quality schooling included shifts in the allocation of education expenditure; infrastructure investments, notably the National School Building programme for the construction and repair of school buildings; and a primary school nutrition programme reaching about 5 million school children.

Four broad *economic* issues arise in the educational area, viz. the requirements of the economy for education and skills – discussed earlier, the fiscal costs of education, resource allocation within education, and productivity of resource use in education, also discussed above.

South Africa allocates a large share of its national resources to public education, with its public education spending ratio of about 7 per cent of GDP amongst the highest in the world.[8] Moreover, education spending increased relatively rapidly 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 education, as fiscal resource shifts were overshadowed by wage increases for teachers (some initially aimed at eliminating apartheid-era discrimination in teacher salaries). In contrast to international experience, teacher

[8] This is even without considering the skills training levy, the earmarked tax on the industrial wage bill introduced to fund and enhance skills training in the workplace.

salaries have outpaced the growth of per capita GDP so that the relative burden of teacher salaries (measured as a fraction of per capita GDP) has increased.[9]

But as Donaldson (1993: 147) perceptively remarked some years ago, *"...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."*

The considerable real shift in spending towards school education after the transition was driven by both inter- and intra-provincial fiscal redistribution. In the process, education spending became well targeted at the poor, i.e. the concentration curve for educational fiscal incidence lies above the diagonal, largely because the poor have more children (see Van der Berg 2002). A Western Cape study shows that the limited remaining fiscal inequalities between schools largely result from differences in qualifications and experience of teachers, a conclusion that probably also holds for other provinces (Fiske & Ladd 2002). Table 12 shows complete equalization of the pupil/teacher ratio in Western Cape schools by 2002, across former departments and also by poverty quintile (where schools are arranged according to the economic status of their neighbourhood). Nationally, teachers paid by the State per 1000 students increased from 24 to 31 in formerly black schools, and decreased from 59 to 31 in formerly white schools. Amazingly, this had virtually no effect on relative performance in these two groups of schools. Remaining differences in pupil/teacher ratios result from private funding that allows richer schools to supplement teaching resources from parental fees. Thus formerly white schools on average have another 12 teachers per 1000 students paid for by parents through the School Governing Body. But even so, the reduction in teacher availability from 59 to 43 per pupil in formerly white schools and the increase in teachers from 24 to 31 in black schools would have been expected to affect school outcomes in the two school groups.

That such a massive shift in teacher resources could take place with relatively little conflict and without major flight of the more affluent into private schools is a tribute to the pragmatism applied by both education authorities and the parent community. The 3 per cent of children in private schools remains small compared with almost one-third in many Latin American countries, which face similar equity problems. Retaining most children in public schools also prevented the flight of scarce qualified teachers to private schools, which would have denuded the public school system of this important collective resource. An important decision here was to continue to allow schools to charge school fees, which allowed particularly more affluent communities to supplement school resources, a step which added to the aggregate resources in public education, albeit at the cost of continuing resource differentials in schools for the rich and the poor (though with private rather than public resources).[10] To deal with some of the resultant problems, conditions were specified under which

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[9] Lee and Barro (1997: 17-18) provide some international evidence of the relative decline of teachers' wages: *"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)."*

[10] See Fiske & Ladd (2002) for a somewhat different perspective on this issue.

exemptions from school fees would be given to parents lacking the ability to pay, and the School Norms and Standards policy was implemented whereby some non-teaching resources were allocated to schools by a formula favouring poorer schools.

Despite the fiscal resource shifts, there are 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. four years of post-matric education – per 1000 pupils in formerly white schools versus only 21 in former black schools. This differential is also reflected across poverty quintiles, as the table shows. Similar discrepancies are likely to apply nationally.

Table 12: Some indicators of performance, resources and teacher qualification by former department and poverty group, 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	35624
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
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**

DET (Dept 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, coloureds, Indian and whites respectively in the apartheid era in the Western Cape.
Q1 to Q5 are the poverty quintiles of schools, derived from the socio-economic status of the area surrounding the schools.
REQV10 is matric or equivalent; each additional increase of 1 implies one more year of tertiary education; REQV17 is a doctorate or equivalent.

Thus, although the government's recent fiscal resource shifts have not fully translated into shifts in real resources, poorer schools now have substantially more teachers. However, this did not necessarily improve outcomes for poorer schools, which struggle to attract better qualified teachers, as the table shows. Selected intervention

that targets the insufficient management and good teaching staff in less affluent schools may be a better answer to this problem than injudiciously throwing fiscal resources at the problem. Good teachers are scarce and it is difficult to entice them to work in deep rural areas and townships where they are most needed. Many prefer to teach in more affluent urban schools, and some have safety concerns about teaching in poor communities.

From an economic efficiency point of view, the malaise of the South African educational system lies less in allocative inefficiency than in x-inefficiency. In a different context, Hanushek (2002a) shows that *on their own* resources seldom significantly improve educational outputs. There is perhaps a stronger case for shifting more financial resources to non-personnel teaching resources; personnel spending is so dominant that even a small shift of this nature would have a major impact on the availability of classroom resources, and this may in any event be the type of resource providing the highest marginal return to further investment, as Filmer & Pritchett (1999) argue. Given few opportunities for promotion within teaching[11], black teachers did not benefit from the wave of black economic advancement following democratisation, thus the strong bargaining power of teacher unions was used to raise their real salaries substantially, crowding out other educational spending. Consequently, after democratisation resources increasingly had to be directed to personnel spending, at the cost of non-personnel spending. From 1995/6 to 1997/8, personnel expenditure in real terms increased by 20% while non-personnel expenditure declined by 17% (South Africa 1998: 27). As growth in pupil numbers – due to continued albeit slowing growth in the school-age population and improved retention of pupils – still exceeds economic growth, a government investigation forecast major funding problems for education in coming years, unless more funds were allocated to education, pupil/teacher ratios rose even further, or teacher salaries declined in real terms, all of which were regarded as fiscally infeasible or politically unpalatable (South Africa 1998). In light of this situation, focusing substantially more attention and funding on non-teacher inputs, while laudable in theory, is unlikely to occur in practice.

However, the clearest need now is to utilise existing resources better. The major inefficiency lies in what used to be the black school system, where the quality of learning in schools is often abysmal. The expenditure review team notes that the COLTS (Culture of Learning, Teaching, and Service) campaign launched in 1996 "*was 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 1998: 35).

School level inefficiencies often result from a principal-agent problem with concomitant incentive problems. Outputs of the educational system are extremely difficult to monitor, as is teacher effort (input), thus low teacher productivity is difficult to overcome through incentive schemes. The educational authorities did attempt to shift monitoring to the parent community as the final "principal", but this was very difficult where parents themselves had had little formal education, as was

[11] De Villiers (1996: 288-9) reports that more than 90 per cent of teachers did not receive more than one promotion in a lifetime of teaching, a situation which is unlikely to have changed much.

the case in precisely those schools where performance was weakest. Moreover, school principals often found it difficult to act against undisciplined teachers or pupils.

One avenue to improve the situation, as in all cases where there is a principal-agent problem, is through providing more information. As in most developing countries, the education authorities have a paucity of information with which to analyse the educational situation and their policy options. Identifying under-performing schools in order to take remedial action requires a better understanding of school performance. Educational policy improvements requires 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: 36) The Department of Education acknowledged this in a recent report where they recommended that they should:

> " - 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 2003)

This would certainly increase openness and information, which are essential to improving school level performance. Teachers, schools and education departments presently have little accountability to parents and communities for education quality. Parents and the community have little information about the effectiveness of specific schools, nor are present and prospective investors ensured of an adequately trained labour force to sustain economic growth. Systematic availability of such information would increase incentives for weaker schools to bring their performance closer into line with better-performing schools serving socio-economically similar communities.

Matriculation results, the only widely available measure of educational output, have hitherto not been analysed in a multivariate framework within the education system. Moreover, literacy and numeracy levels are already far below expectations at early ages: According to Moloi (2005), most pupils at Grade 6 level perform at Grade 3 level or worse in Maths tests. So the problem may require intervention much earlier than Matric.

8. Conclusion

Improving black education is crucial to reducing the racial earnings gap in South Africa. Despite the lasting influence of apartheid on the schooling system, 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 predominantly black schools, as reflected in cognitive tests and matriculation results. 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 alone is not a solution to the problem of weak educational performance – indeed, some schools perform excellently with limited resources. This accords with much international evidence that resource inputs in isolation contribute little to improving educational outcomes.

Robust economic growth may reduce poverty and racial inequality in coming decades and arrest the trend towards increased inequality within race groups. 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. As Kanbur (1998: 20) puts it, "*The distribution of physical and human capital emerges from the theoretical and empirical literature as the key to distributional consequences of growth, and as the determinant of growth itself.*" This requires that urgent attention be given 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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