

# Convergence over Space and Generations in the Post-Apartheid South Africa

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# Convergence over Space and Generations in the Post-Apartheid South Africa<sup>1)</sup>

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## 1. Introduction

Location becomes critical when access to opportunities is distributed unevenly over space. For example, when good schools are concentrated in urban areas, one must live in these areas to have good educational opportunities, and therefore good job prospects. This phenomenon is commonly observed in rapidly growing economies where there is a significant rural-urban disparity. Another example can be found in South Africa, which experienced nearly 30 years of apartheid policies by which different population groups were segregated in separate residential areas with unequal access to employment, education and

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public services<sup>3)</sup>. As a consequence, location was a critical factor.

This paper examines the problem of how historical and location factors affect access to quality education in post-apartheid South Africa, and aims to disentangle the factors underlying spatially clustered opportunities for quality education through the use of a unique database combining the 2002 school census and the 2001 South African Census Community Profile Database. With GIS information, this data enables us to jointly identify the location of school and to correlate that with local socio-economic characteristics.

To assess the quality of education, information on school fees charged at local public schools is drawn upon. In South Africa, school fees represent not only school quality, but also the likelihood of residents to be able to afford investments in schooling in the next generation (Yamauchi and Nishiyama, 2005)<sup>4)5)</sup>. Until recently, government subsidies in South Africa have been limited, so financing of schools relies heavily on the collection of school fees - a user charge - from parents. School governing bodies (SGBs), which consist of the principal,

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3) For accounts of the general situation in South African education, see Bot, Wilson, and Dove (2000), Crouch (1996), and Kriege et al. (1994).

4) Yamauchi and Nishiyama (2005) showed the significant effect of school fee on learner-educator ratio and the number of non-subsidized educators. For the importance of school resources such as learner-educator ratio in learners' performance and labor-market outcomes, see Card and Krueger (1996), Case and Deaton (1999) and Case and Yogo (1999).

5) Public school fee is determined in school governing body that consists of school principal, teachers, parents, community leaders, and in secondary schools, some learners. Therefore, school fee represents not only school quality, but also the community's capability of financing local public schools. Yamauchi and Nishiyama (2005) analyze the effect of local income distribution on the determination of school fee, showing that inequality decreases school fee. Thus, low income groups in the community pull down school fee, which decreases school quality for all children. In different contexts, Foster and Rosenzweig (2001) and Chattopadhyay and Duflo (2004) show the importance of local governance in public investment decision-making.

teachers, community leaders, parents, and in some secondary schools, learners, set school fees. Accordingly, school fees charged represent the community's ability to pay for education<sup>6/7)</sup>. SGBs have played a greater role even now when a recently revised funding reform was implemented, whereby provincial governments gradually allocate

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6) In another aspect, Selod and Zenou (2003) examine the role of school fee in screening children from different backgrounds in a spatial model, showing that whites tend to overprice education in order to limit black students at the private school.

7) The 1996 Norms and Standards for School Funding (Republic of South Africa, 1998), in response to the South African School Act (Republic of South Africa, 1996) mentions that 45: The SASA (South African School Act) imposes a responsibility on all public school governing bodies to do their utmost to improve the quality of education in their schools by raising additional resources to supplement those which the state provides from public funds (section 36). All parents, but particularly those who are less poor or who have good incomes, are thereby encouraged to increase their own direct financial and other contributions to the quality of their children's education in public schools. The act does not interfere unreasonably with parents' discretion under the law as to how to spend their own resources on their children's education.

46: Ironically, given the emphasis on redress and equity, the funding provisions of the Act appear to have worked thus far to the advantage of public schools patronised by middle-class and wealthy parents. The apartheid regime favored such communities with high-quality facilities, equipment and resources. Vigorous fund-raising by parent bodies, including commercial sponsorships and fee income, have enabled many such schools to add to their facilities, equipment and learning resources, and expand their range of cultural and sporting activities. Since 1995, when such schools have been required to down-size their staff establishments, many have been able to recruit additional staff on governing body contracts, paid from the school fund.

47: Poor people, on the other hand, especially in former homeland areas, have contributed a disproportionate share of their incomes over many decades to their building, upkeep and improvement of schools, through school funds and other contributions, including physical labour. All too many schools in poor rural and urban working-class communities still suffer the legacy of large classes, deplorable physical conditions, and absence of learning resources, despite a major RDP National School Building Programme, and many other projects paid directly from provincial budgets. Yet the educators and learners in poor schools are expected to achieve the same levels of learning and teaching as their compatriots.

48: Such contractions within the same public school system reflect past discriminatory investment in schooling, and vast current disparities in the personal income of parents. The present document addresses these inequalities by establishing a sharply progressive state funding policy for ordinary public schools, which favours poor communities.

school subsidies, according to local poverty measures.

There are two kinds of factors that are relevant to the way in which school fees (and thus school quality) are determined. First, the legacy of apartheid imposes historical constraints on the spatial distribution of income and population groups. Good schools are located in selected areas. This has created racial and socio-economic homogeneity within neighborhoods<sup>8)</sup>. Second, even if the mobility of populations was unrestricted after the abolition of apartheid, household-level financial constraints coupled with the imperfect credit market often prevents the poor from moving into those well-off areas that have better educational opportunities. Thus, the opportunity for better education is geographically correlated with land prices<sup>9)</sup>. Even though African children can commute to formerly white schools, this incurs additional transportation and time costs for them. Accordingly, this paper aims to explore the impact of apartheid on the spatial distribution of quality education in the post-apartheid democratic regime where the spatial mobility of people is legally unrestricted<sup>10)</sup>.

The paper is organized into sections, as follows: Section 2 illustrates a simple model that describes: (i) how residential rent prices and uneven labor demand can affect human capital investments; and (ii) how imper-

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8) Yamauchi (2005b) discussed the importance of observed heterogeneity in neighborhood in the context where agents learn about returns to schooling and decide schooling investment in children. Whether the society is heterogeneous or homogeneous has some dynamic implications.

9) This point has not been seriously examined yet, though casual observations support this proposition.

10) Yamauchi (2005a) examined how learner-education ratio has changed in the period of 1996–2000, splitting the sample in formerly African, White, Coloured and Indian schools. He showed that a change in the number of educators is smaller in formerly African schools than formerly White schools, in response to a change in the number of learners, which implies that the former group has been more likely to face financial constraints.

fections in the credit market can create spatial correlations between school quality and income level. Since one's choice of location is legally unrestricted in the post-apartheid regime, the analysis assumes that location chosen is optimum given the existing conditions. This study has direct implications for human capital investments since location choice affects the quality of child education that ultimately determines income opportunities for the next generation. The empirical approach taken is discussed based on the model applied.

Section 3 summarizes the empirical findings. First, some key features of school fee distributions and population group compositions in South Africa are demonstrated and linked with the history of apartheid. The distribution is bimodal, with a higher peak in formerly non-African schools and in areas where white population dominated. Second, it is also shown that formerly non-African schools are located in the areas where the majority population is still non-African.

Finally, the results show that local population-group composition and former apartheid departments of education still influence the way that school fees (and thus school quality) are determined at local public schools, and that income opportunity (as measured by average household income, average years of schooling and unemployment rate) is also significant. This rejects the perfect credit market hypothesis where parental income and schooling have no effect on school fee choice (the ability to finance child schooling). Interestingly, financial constraints are found to be more important than the apartheid historical constraints in the metropolitan areas of Johannesburg, Cape Town and Durban.

Given the existing patterns of residential location and school choice, the question remains: how should the government attempt to improve

school quality and support the poor with spatial targeting, since poor households and poor schools (or rich households and good schools) are likely to be locked in certain areas?

## 2. Framework

### 2.1 Set-up

In this section, a simple model describing school and residential location choices and their effect on human capital investment for the next generation is laid out. We begin with a basic model that does not include residential rent prices but does assume a perfect credit market. In this model, human capital investment is shown to be efficient.

Initially, this model looks similar to Fujita (1989), in which the maximum amount an agent is willing to pay for a location is considered. In the model below, however, the spatial determination of residential rent prices and school fees is not endogenized. Residential and schooling prices are taken as given when residential and school choices are analyzed in a standard intertemporal framework in which the agent decides human capital investment and intertemporal credit transaction.

Assume that parental preference incorporates altruism toward the next generation  $u(c_i^1) + \beta v(c_i^2)$  where  $c_i^1$  and  $c_i^2$  are household consumption  $i$  in the current and next generations, and  $\beta \in (0,1)$  is the discount factor (altruism). Human capital for the next generation is produced through the following production function  $h(p_i, x_i)$  where  $p_i$  is school quality and  $x_i$  is child time input. It is assumed that production is increasing and concave in both arguments and  $h_{px} > 0$ . Time input is the

total time available for learning  $T$  minus commuting time to school,  $x_i = T - \frac{\phi}{2}(s_i - z_i)^2$  where  $s_i$  and  $z_i$  denote location of school and residence respectively, and  $\phi(s_i - z_i)^2$  denotes commuting time. The total time endowment is normalized as  $T=1$  below. Since  $x_i > 0$ , the distance between school and residence is bounded from above.

Let  $z=0$  be the center. As  $z$  increases, location becomes further from the center. Similarly,  $s=0$  represents school in the center.

It is assumed that expenditure on education directly influences school quality and that school location determines school fee (and therefore quality). For simplicity, assume that school fee and quality are  $p(s_i)$ , where  $p'(s_i) < 0$  and  $p''(s_i) \geq 0$ . That is, the availability of good schools is limited the further you move from the center.

Finally, budget constraints are given as:

$$\begin{aligned} c_i^1 + p(s_i) &= a_{0i} + a_i + W_i \\ c_i^2 &= h(p_i, x_i) - (1+r)a_i \end{aligned}$$

where  $a_i$  is credit borrowed from the credit market,  $a_{0i}$  is the initial asset, and  $r > 0$  is the interest rate. Parents' labor income  $W$  is determined by their human capital  $h_{0i}$ . Thus, households can borrow credit to finance schooling investment in the next generation.

The first order conditions are summarized as:

$$u_c - \lambda = 0 \tag{1}$$

$$\beta v_c h_x \phi(s_i - z_i) = 0 \tag{2}$$

$$\beta v_c [h_p p'(s_i) - h_x \phi(s_i - z_i)] - \lambda p'(s_i) = 0 \tag{3}$$

$$u_c = \beta(1+r)v_c \tag{4}$$

where  $\lambda$  is the Lagrange multiplier for the first-period budget constraint. The condition (2) implies that  $s_i^* = z_i^*$ , that is, school location is



identical to residential location. From the conditions (3) and (4), human capital investment is efficient:

$$MRS \equiv \frac{u_c}{\beta v_c} = h_p(p^*, T) = 1 + r$$

where  $x^* = T$ . This model assumes that all households choose an identical level of school quality investment and school (residence) location, no matter what the labor-market income<sup>11</sup>).

## 2.2 Residential Rent

Next, monetary cost for location choice (rent) is introduced, denoted by  $R(z_i) > 0$ . Assume that  $R'(z_i) < 0$ , so that rent is decreasing the further the distance from the center, similar to school quality and cost. Also assume that  $R(z_{0i})$  is the asset value of the residential location. Thus, net relocation cost is  $R(z_i) - R(z_{0i})$  (cost is zero if  $z_i = z_{0i}$ ). Maintaining the other assumptions, the budget constraint is changed for the first period:

$$c_i^1 + p(s_i) + R(z_i) = R(z_{0i}) + a_i + W_i$$

The first order condition with respect to  $z_i$  is altered to:

$$\beta v_c h_x \phi(s_i - z_i) - \lambda R'(z_i) = 0 \quad (2')$$

The conditions (2'), (3), (1) and (4) provide:

$$h_p = (1 + r) \left[ 1 + \frac{R'(z_i)}{p'(s_i)} \right] > 0 \quad (5)$$

where  $\frac{R'(z_i)}{p'(s_i)}$  characterizes deviation from efficiency. Since  $\frac{R'(z_i)}{p'(s_i)} > 0$

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11) With borrowing constraint (no opportunity of financial asset-holding), an increase in  $W_i$  decreases  $z_i^*$  (approaching to the center), which increases  $p^*$ .

and  $x < T$ , this leads to underinvestment in human capital. In this sense, location choice for school and residence  $(s, z)$  affects efficiency in human-capital investment. School-fee expenditure (investment in quality) is smaller than the benchmark case since  $\frac{R'(z_i)}{p'(s_i)} > 0$  due to additional residential rent.

Since  $R'(z_i) < 0$ , the condition  $s_i < z_i$  holds, that is, school is closer to the center than residential location. Households can live far from the center to save on residential rent prices and send children to a school closer to the center. Commuting time for children, however, will reduce time input in schooling investment, so they do not live far from school. This creates a spatial correlation between residential and school choice.

### 2.3 Missing Credit Market

If the credit market is missing, the marginal rate of substitution is not equal to the gross interest rate. The credit market below is closed to clarify its implications<sup>12</sup>. The Eq. (5) is modified as:

$$h_p = MRS(z_{0i}, W_i) \left[ 1 + \frac{R'(z_i)}{p'(s_i)} \right] \quad (5)$$

where  $MRS$ , marginal rate of substitution, is a function of residential location  $z_{0i}$  and parents' labor income  $W_i$ . Agents cannot borrow to finance moving and child schooling costs to repay in the next generation. As  $R(z_{0i})$  and/or  $W_i$  get smaller,  $MRS$  increases so that the optimal investment in schooling (school expenditure) becomes smaller, and therefore school location moves further from the center. Therefore,

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12) Suppose that  $r(z_{0i}, W_i)$  decreases in  $R(z_{0i})$  and  $W_i$  (borrowing cost is high for the poor), then  $p^*$  becomes smaller (since  $h_p$  becomes larger and  $h$  is concave) when  $R(z_{0i})$  and/or  $W_i$  are small.

the location in which agents live initially does matter in human capital investment.

## 2.4 Empirical Approach

I discuss empirical specification that is tractable in our empirical setting. For this purpose, I make some parametric assumptions on utility function as well as human capital production function. Assume that  $h(p, x) = xf(p) = xp^\eta$ ,  $R'(z) = -k_1$  and  $p'(s) = -k_2$ .

The spatial distribution of earnings opportunities and the role of parents' human capital is also introduced. Assume that  $W(h_{0i}, z_i) = w(h_{0i})[1 - \gamma z_i]$  where  $w(h_{0i})$  is the maximum wage opportunity for workers with human capital  $h_{0i}$  (for example, schooling). Here, as the distance from the center increases, income decreases at the rate of  $\gamma > 0$ . Another interpretation is that earnings opportunity (the available wage for a given amount of human capital) decreases as the distance from the center increases due to the uneven spatial distribution of labor demand. Therefore,  $W(h_{0i}, z_i)$  is increasing in  $h_{0i}$  and decreasing in  $z_i$ .<sup>13)</sup>

Under these assumptions, Eq. (5') is written as:

$$\eta x_i p^{\eta-1} = MRS_i \left[ 1 + \frac{\gamma w(h_{0i}|z_i) - k_1}{-k_2} \right]$$

where  $MRS_i$  denotes the marginal rate of intertemporal substitution, which is  $1 + r$  when the credit market is perfect and  $\frac{u_c}{\beta v_c}$  when the credit market does not exist. Taking log and rearranging:

$$\begin{aligned} \ln p(s) &\approx \frac{1}{1-\eta} + \frac{k_1}{k_2(1-\eta)} - \frac{\phi}{2(1-\eta)}(z_i - s)^2 \\ &\quad - \frac{1}{1-\eta} \ln MRS_i + \frac{\gamma}{k_2(1-\eta)} w(h_{0i}|z_i) \end{aligned}$$

Next, the conditional expectations over  $z_i$  given  $s$  are considered. Note that  $x \geq 0$ , which defines the area boundary for residential choice  $z_i$  for a particular school  $s$ . That is,  $z_i \in B(s) \equiv \left[ s - \sqrt{\frac{2}{\phi}}, s + \sqrt{\frac{2}{\phi}} \right]$ . Fix  $s$  and take expectations over  $z_i$  in the school neighborhood. The following is obtained:

$$\ln p^e(s) = \alpha - \frac{1}{1-\eta} E_z[\ln MRS_i | s, B(s)] + \frac{\gamma}{k_2(1-\eta)} E_z[w(h_{0i}|z)|s, B(s)] + \varepsilon_s \quad (6)$$

where  $\alpha = \frac{1}{1-\eta} \ln \eta + \frac{k_1}{k_2(1-\eta)} - \frac{\phi E_z[(z_i - s)^2 | s, B(s)]}{2(1-\eta)}$ . The error term  $\varepsilon_s$  captures spatial correlation within the Census area. For simplicity, it is assumed that  $B(s)$  corresponds to the Census subplace (described below)<sup>14,15</sup>.

13) With these changes, Eq. (5) is modified as:

$$h_p(p^{**}, x^{**}) = (1+r) \left[ 1 + \frac{\gamma w(h_{0i}) + R'(z)}{p'(s)} \right] \quad (5')$$

The distance between school and residence is:

$$s - z = (1+r) \frac{\gamma w(h_{0i}) + R'(z)}{h_x \phi}$$

It is observed that as  $\gamma w(h_{0i}) + R'(z) \rightarrow +0$  (that is, as  $w(h_{0i})$  increases),  $h_p(p^{**}, x^{**}) \rightarrow h_p(p^*, T)$  and  $s^{**} \rightarrow z^{**}$  (so  $x^{**} \rightarrow T$ ). Since agents with large  $h_{0i}$  have high opportunity costs in living away from the center, they have a larger incentive to live closer to the center despite of higher residential rent. High  $h_0$  and  $w(h_0)$  class tend to invest in  $p(s^*)$  and live near  $s^*$  so that their choice approaches to efficient human capital investment ( $h_p(p(s^*), T) = 1+r$ ).

14) In reality, some children commute greater distances to school, for example outside the Census subplace. This creates measurement errors. The majority of children, however, attend school in their neighborhood, especially in non-urban areas.

15) Note that in Eq. (6), if the credit market is perfect, the second term is constant and therefore the marginal effect of the area-average labor income is  $\frac{\gamma}{k_2(1-\eta)}$ . When credit market does not exist, however, the marginal effect becomes larger since:

$$\frac{\partial \ln p(s)}{\partial w(h_{0i}|z_i)} = \frac{\gamma}{k_2(1-\eta)} - \frac{1}{1-\eta} \frac{\partial \ln MRS_i}{\partial c_i^{1*}} \frac{\partial c_i^{1*}}{\partial w(h_{0i}|z_i)} > \frac{\gamma}{k_2(1-\eta)}$$

where  $\frac{\partial \ln MRS_i}{\partial c_i^{1*}} < 0$  and  $MRS_i$  are not observable. Note that if  $\gamma=0$  (i.e.,  $W(h_{0i}) = w(h_{0i})$ ) and the credit market is perfect,  $\frac{\partial \ln p(s)}{\partial w(h_{0i}|z_i)}$  is zero.

In the application below,  $E_z[\ln MRS_i | s, B(s)]$  is approximated as a linear function of income opportunities  $W(h_0)$ , represented by (the log of) average income, the average years of schooling, and unemployment rate in the school neighborhood (Census subplace), and location types  $R(z)$ , represented by the percentage shares of settlement types such as sparse, tribal, farm, smallholding, urban, informal, industrial, institutional and hostel settlements and population density.

### 3. Empirical Evidence

#### 3.1 School Fee, Apartheid Education Departments and School Neighborhood

This section clarifies some features of the public education system in South Africa, using school fees as a proxy for school quality. For this purpose, we need to be aware of the history of modern South Africa. Two factors are important here. The first factor is the segregation policy adopted in apartheid education, by which population groups were separated from each others in various dimensions. In public education, different departments were responsible for different population groups, and children from different population groups were segregated in separate schools. The second factor is the spatial distribution of residential areas and school locations. Due to the apartheid segregation policy, different population groups were not allowed to live in the same area. Thus, formerly white schools are located in formerly whites areas.

The data come from two different sources. Local characteristics are taken from the Census 2001 Community Profile (Statistics South Africa: Stats SA). This database provides distributions of socio-

economic characteristics in the Census 2001 at subplace level for the whole country<sup>16</sup>). It covers, for example, education, labor force, migration, settlement types, and population group compositions. Officially, subplace is defined as the smallest geographical unit available from the Census, by which we can identify the location as well as the characteristics.

GIS data available in school censuses can help identify in which subplace a school is located<sup>17</sup>). The school identification codes, EMIS, enable us to merge the Census 2001 subplace data and school censuses. School fees in 2001 are captured in the Annual School Survey 2002 (National Department of Education). The information on former education departments is available in the School Register of Needs 2000 (National Department of Education).

Figure 1 depicts the distribution of annual school fees charged at public schools in 2001. The graph exhibits a clear bimodal distribution, showing that a group of public schools charge higher fees than the majority do. It is also possible that their locations have certain characteristics in common.

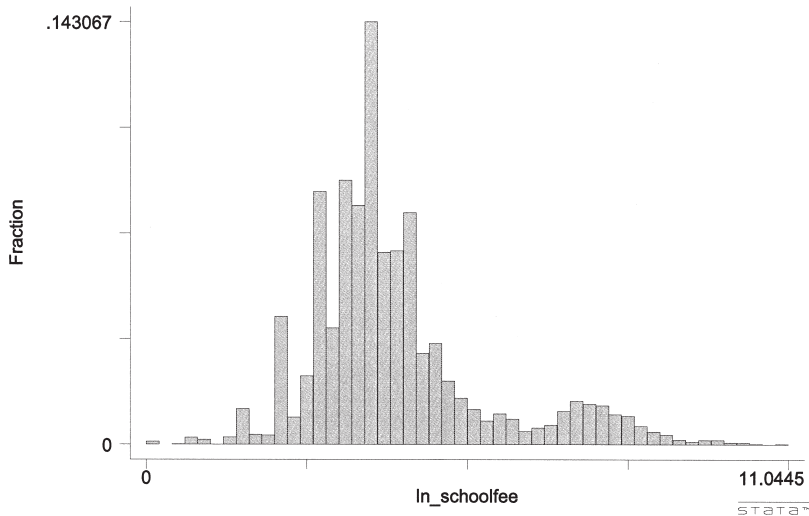
Figure 2 depicts school fee distributions for different former education departments to illustrate the impact of apartheid on school fee distribution. In South Africa before 1994, Department of Education and Culture: House of Assembly (HOA), House of Representatives (HOR), and House of Delegates (HOD) governed white, coloured and Indian schools, respectively, throughout the country. Transvaal Education

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16) I used a computer software that the Statistics South Africa invented to have the distributions of socio-economic variables in each subplace.

17) Using the same datasets, Yamauchi and Nishiyama (2005) analyze the effect of local income distribution within subpalce on school fee determination in public schools therein.

Figure 1 The distribution of log annual school fee



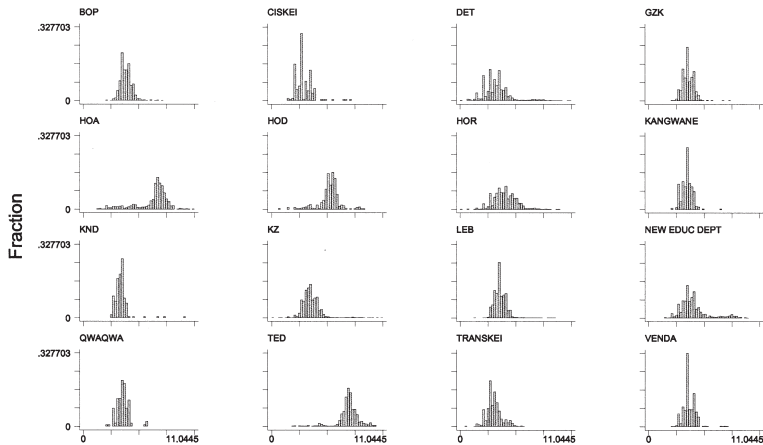
Department (TED) represented white schools in Gauteng province. Schools established after 1994 are categorized as a new group. These figures clearly show the importance of historical influence from the former regimes. Those schools that were formerly under the control of HOA, HOR, HOD and TED charged higher school fees than other groups. The finding suggests that, given that school fees are positively correlated with school quality, formerly whites, coloured and Indian schools provide higher quality education than the majority of formerly African schools do.

Whites—Department of Education and Culture: House of Assembly (HOA)

Coloured—Department of Education and Culture: House of Representatives (HOR)

Indian—Department of Education and Culture: House of Delegates

Figure 2 Former departments and log annual school fee



STATA™

(HOD)

African—Department of Education and Training (DET)

African—Bophuthatswana Education Department (BOP)

African—Ciskei Education Department (CISKEI)

African—Gazankulu Department of Education (GZK)

African—KaNgwane Department of Education (KaNGWANE)

African—KwaNdebele Department of Education (KND)

African—KwaZulu Department of Education and Culture (KZ)

African—Lebowa Department of Education (LEB)

African—QwaQwa Department of Education (QWAQWA)

African—Transkei Education Department (TRANSKEI)

African—Venda Education Department (VENDA)

Whites—Transvaal Education Department (TED)

All races—Schools established after 1994, New Education Department



Next, the relationship between former departments and population group composition in school neighborhoods is demonstrated. Table 1 shows the proportions of African, whites, coloured and Indian/Asian populations in the Census subplace of school location. Note that the population group compositions are computed from the Census 2001 Community Profile Database, whereas former departments are of the apartheid regime before 1994.

It is interesting to confirm that schools formerly governed by HOA are located in subplaces where the population of whites is still the majority (46.94% in primary, and 56.29% in secondary). Similarly, formerly HOD-schools are in subplaces where the majority population is Indian. Formerly HOR and TED schools are in coloured and white-dominant areas respectively. Schools under the other former departments for African population are located in predominantly African

Figure 3 School fee and proportion of white population in subplace

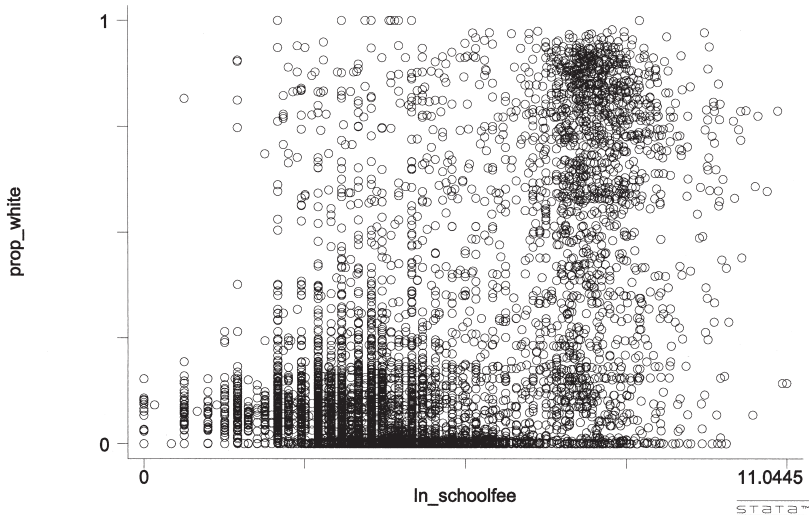


Table 1 Population groups compositions in school neighborhood

	Obs	Mean	Std Dev	Min	Max
Primary schools:					
Bophuthatswana Education Department (BOP) - African					
Proportion African	895	0.990574	0.0241924	0.7552603	1
Proportion White	895	0.0043385	0.0201726	0	0.2306261
Proportion Coloured	895	0.0048084	0.0108269	0	0.1949458
Proportion Indian/Asian	895	0.0002791	0.0010582	0	0.016002
Ciskei Education Department (CISKEI) - African					
Proportion African	551	0.9937563	0.0448848	0.0255829	1
Proportion White	551	0.0012011	0.0087779	0	0.1168831
Proportion Coloured	551	0.0031622	0.0150152	0	0.1191619
Proportion Indian/Asian	551	0.0018803	0.0410759	0	0.9637306
Department of Education and Training (DET) - African					
Proportion African	5380	0.8873573	0.1672023	0	1
Proportion White	5380	0.080577	0.12462	0	1
Proportion Coloured	5380	0.0283751	0.0898522	0	0.9874739
Proportion Indian/Asian	5380	0.0036905	0.0355958	0	0.9548488
Gazankulu Department of Education (GZK) - African					
Proportion African	380	0.9976391	0.006119	0.9594595	1
Proportion White	380	0.001214	0.0042512	0	0.0365854
Proportion Coloured	380	0.0008391	0.0037339	0	0.0405405
Proportion Indian/Asian	380	0.0003078	0.0010843	0	0.0078762
Department of Education and Culture: House of Assembly (HOA) - White					
Proportion African	637	0.3378059	0.3356432	0	1
Proportion White	637	0.4894076	0.3237579	0	0.9710921
Proportion Coloured	637	0.1481002	0.2371969	0	0.9740787
Proportion Indian/Asian	637	0.0246863	0.0504363	0	0.558296
Department of Education and Culture: House of Delegates (HOD) - Indian					
Proportion African	331	0.3177387	0.3230634	0.0034247	1
Proportion White	331	0.0607398	0.1713729	0	0.8977141
Proportion Coloured	331	0.0482009	0.1383091	0	0.9862803
Proportion Indian/Asian	331	0.5733206	0.3796239	0	0.9885057
Department of Education and Culture: House of Representatives (HOR) - Coloured					
Proportion African	1378	0.2563067	0.3321149	0	1
Proportion White	1378	0.1023137	0.1501915	0	1
Proportion Coloured	1378	0.6316433	0.3432725	0	1
Proportion Indian/Asian	1378	0.0097363	0.0498904	0	0.8288214
KaNgwane Department of Education (KaNGWANE) - African					
Proportion African	243	0.991257	0.0578342	0.1223574	1
Proportion White	243	0.0023508	0.0135608	0	0.1614526
Proportion Coloured	243	0.0028519	0.0059354	0	0.076936

Proportion Indian/Asian	243	0.0035403	0.0510317	0	0.7957158
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KwaNdebele Department of Education (KND) - African

Proportion African	120	0.989712	0.0596302	0.3596391	1
Proportion White	120	0.0078073	0.0557192	0	0.5997565
Proportion Coloured	120	0.0010871	0.0018648	0	0.0160412
Proportion Indian/Asian	120	0.0013936	0.0060595	0	0.0315052

KwaZulu Department of Education (KN) - African

Proportion African	2455	0.9810502	0.1000884	0.0662055	1
Proportion White	2455	0.0142151	0.0842536	0	0.9160079
Proportion Coloured	2455	0.0016966	0.0061077	0	0.1028499
Proportion Indian/Asian	2455	0.0030381	0.0238106	0	0.7298815

Lebowa Department of Education (LEB) - African

Proportion African	1269	0.9940952	0.0533017	0	1
Proportion White	1269	0.0047994	0.0525187	0	1
Proportion Coloured	1269	0.0009075	0.0044447	0	0.0645449
Proportion Indian/Asian	1269	0.0001979	0.0024206	0	0.0833333

New Education Department

Proportion African	634	0.9041989	0.2407903	0.0071463	1
Proportion White	634	0.0495431	0.1535792	0	0.9785612
Proportion Coloured	634	0.0391079	0.1550456	0	0.9694915
Proportion Indian/Asian	634	0.0071501	0.0619405	0	0.937833

QwaQwa Department of Education (QWAQWA) - African

Proportion African	53	0.9918118	0.0280745	0.8573127	1
Proportion White	53	0.0017608	0.0072886	0	0.0502622
Proportion Coloured	53	0.002466	0.0075523	0	0.039239
Proportion Indian/Asian	53	0.0039614	0.0185001	0	0.0963139

Transvaal Education Department (TED) - White

Proportion African	346	0.3035835	0.240016	0.041958	1
Proportion White	346	0.6384308	0.2574611	0	0.958042
Proportion Coloured	346	0.0284867	0.0433045	0	0.3046937
Proportion Indian/Asian	346	0.029499	0.067877	0	0.6671807

Transkei Education Department (TRANSKEI) - African

Proportion African	956	0.9960843	0.0230721	0.4553049	1
Proportion White	956	0.0015771	0.0171041	0	0.4438875
Proportion Coloured	956	0.0020636	0.0096468	0	0.1428571
Proportion Indian/Asian	956	0.000275	0.0024558	0	0.0387079

Venda Education Department (VENDA) - African

Proportion African	423	0.9908934	0.0448398	0.6551724	1
Proportion White	423	0.0066493	0.0391237	0	0.3103448
Proportion Coloured	423	0.0007636	0.0043056	0	0.0493436
Proportion Indian/Asian	423	0.0016937	0.0080313	0	0.0486322

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Secondary schools:

Bophuthatswana Education Department (BOP) · African

Proportion African	200	0.9911405	0.023752	0.7647059	1
Proportion White	200	0.0045047	0.0221605	0	0.2352941
Proportion Coloured	200	0.0039669	0.0066108	0	0.0418542
Proportion Indian/Asian	200	0.0003879	0.0011401	0	0.0072289

Ciskei Education Department (CISKEI) · African

Proportion African	213	0.9955797	0.0285582	0.618267	1
Proportion White	213	0.0020794	0.0240353	0	0.3501171
Proportion Coloured	213	0.002224	0.0117528	0	0.15
Proportion Indian/Asian	213	0.0001169	0.0006627	0	0.006135

Department of Education and Training (DET) · African

Proportion African	918	0.8832399	0.2477	0	1
Proportion White	918	0.0754543	0.1912212	0	1
Proportion Coloured	918	0.0323407	0.1224594	0	0.9752309
Proportion Indian/Asian	918	0.0089651	0.0610871	0	0.9756098

Gazankulu Department of Education (GZK) · African

Proportion African	193	0.995358	0.0197352	0.7543604	1
Proportion White	193	0.0033395	0.018802	0	0.2456395
Proportion Coloured	193	0.0008119	0.0032554	0	0.0405405
Proportion Indian/Asian	193	0.0004906	0.0015856	0	0.010453

Department of Education and Culture: House of Assembly (HOA) · White

Proportion African	282	0.2674725	0.2753447	0	1
Proportion White	282	0.5629102	0.2922694	0	0.9672579
Proportion Coloured	282	0.1400417	0.2109491	0	0.9653361
Proportion Indian/Asian	282	0.0295756	0.0523936	0	0.3062209

Department of Education and Culture: House of Delegates (HOD) · Indian

Proportion African	102	0.1836393	0.2368411	0.0057471	1
Proportion White	102	0.036181	0.1496807	0	0.9404537
Proportion Coloured	102	0.0538794	0.1605563	0	0.9826432
Proportion Indian/Asian	102	0.7263002	0.3122672	0	0.9885057

Department of Education and Culture: House of Representatives (HOR) – Coloured

Proportion African	270	0.1625991	0.2753492	0	1
Proportion White	270	0.1162389	0.2441152	0	0.9690049
Proportion Coloured	270	0.7080628	0.3575151	0	0.9976985
Proportion Indian/Asian	270	0.0130991	0.0312058	0	0.3442088

KaNgwane Department of Education (KaNGWANE) · African

Proportion African	96	0.9964311	0.0039772	0.9756452	1
Proportion White	96	0.0003617	0.0006797	0	0.0033113
Proportion Coloured	96	0.0029352	0.0038421	0	0.0221738
Proportion Indian/Asian	96	0.000272	0.0008302	0	0.0072816

KwaNdebele Department of Education (KND) · African

Proportion African	68	0.9907277	0.0346795	0.7467119	1
Proportion White	68	0.0065432	0.0327797	0	0.2432999
Proportion Coloured	68	0.0012242	0.0015604	0	0.0078914
Proportion Indian/Asian	68	0.0015049	0.0065072	0	0.0315052

## KwaZulu Department of Education (KN) - African

Proportion African	1016	0.9794089	0.10816	0.0360502	1
Proportion White	1016	0.0108152	0.0716255	0	0.8764941
Proportion Coloured	1016	0.0017328	0.0062666	0	0.1028499
Proportion Indian/Asian	1016	0.0080432	0.0658279	0	0.9548488

## Lebowa Department of Education (LEB) - African

Proportion African	769	0.986849	0.0825103	0	1
Proportion White	769	0.0117847	0.080588	0	1
Proportion Coloured	769	0.0008818	0.0043461	0	0.0645449
Proportion Indian/Asian	769	0.0004845	0.0052286	0	0.0833333

## New Education Department

Proportion African	475	0.9372604	0.1877237	0.0170306	1
Proportion White	475	0.0370632	0.1373713	0	0.8782265
Proportion Coloured	475	0.0199042	0.0937118	0	0.9798253
Proportion Indian/Asian	475	0.0057723	0.0465234	0	0.8647922

## QwaQwa Department of Education (QWAQWA) - African

Proportion African	38	0.9979346	0.0042321	0.9764243	1
Proportion White	38	0.0005939	0.0026491	0	0.0162083
Proportion Coloured	38	0.0009246	0.0018682	0	0.0073674
Proportion Indian/Asian	38	0.0005469	0.0017181	0	0.0089021

## Transvaal Education Department (TED) - White

Proportion African	157	0.307247	0.2567044	0	1
Proportion White	157	0.6436602	0.2683401	0	1
Proportion Coloured	157	0.0255006	0.0391447	0	0.3046937
Proportion Indian/Asian	157	0.0235923	0.0338762	0	0.1936036

## Transkei Education Department (TRANSKEI) - African

Proportion African	313	0.9940195	0.0241702	0.6981802	1
Proportion White	313	0.0013147	0.0081216	0	0.1
Proportion Coloured	313	0.0040125	0.020139	0	0.2924989
Proportion Indian/Asian	313	0.0006533	0.0050607	0	0.0833333

## Venda Education Department (VENDA) - African

Proportion African	176	0.9869532	0.0538458	0.6551724	1
Proportion White	176	0.0095463	0.0468931	0	0.3103448
Proportion Coloured	176	0.001016	0.0053596	0	0.0493436
Proportion Indian/Asian	176	0.0024845	0.0098381	0	0.0486322

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The proportion of each population group in the Census subplace where a school is located.

residential areas.

To disentangle the spatial relationship between school fees and population composition, Figure 3 plots school fees against the proportion of whites in a given subplace. Given the fact that the mobility of African population into formerly white residential areas was prohibited in the apartheid regime and is still limited now due to financial reasons, the proportion of white population tells us whether a particular school is located in a formerly white area.

Interestingly, the distribution falls into two groups (concentrations). Higher school fees are likely to be charged in the areas where the majority population is white<sup>18</sup>). Therefore, Figure 3 (together with Figure 2 and Table 1) demonstrates not only the systematic segregation policy in the apartheid-regime education system, but also that location factors and spatial segregation of different socio-economic groups (correlated with population groups) are important in determining opportunities for quality education in the next generation.

### 3.2 School Fee Determination—History and Market

First, the points observed in the previous section are confirmed, namely that former education departments and the proportion of white population in subplace influence the ability to pay for education quality. Second, the implications of Section 2 are tested here. Income opportunities are measured by average household income, the average years of schooling in the population of ages 20–64, and the unemployment rate. To characterize economic values of residential areas, the distribution

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18) Africans move into formerly Whites residential areas, while Whites do not move into predominantly African residential areas. In some exceptions such as in the downtown of Johannesburg, the inflow of African population wiped out Whites residents (business), who moved to new suburban areas.

of settlement types and population density from the Census 2001 are used.

Table 2 shows two sets of results in: (i) South Africa as a whole; and (ii) metropolitan areas - Johannesburg, Cape Town and Durban - where population inflow into the cities has been large since 1994. Each specification includes district fixed effects.

Column 1 has factors that represent apartheid regime and residential area types. First, the proportions of African and whites populations have significant negative and positive effects on school fees, respectively. Coloured and Indian/Asian cases have been omitted. It is clear that spatial segregation of population groups significantly affects school fees.

Second, schools formerly under HOA, HOD and TED charge significantly higher school fees. The omitted case here is schools established after 1994 under the new education department. Combined with previous segregations in residential locations, apartheid still influences school quality.

Third, the distribution of residents that live in urban, informal, industrial, institutional or hostel settlements significantly alter school fees. Omitted cases include sparse, tribal, farm or small holding types. Therefore, schools in urban areas are likely to charge higher school fees, leading to higher education quality. The effect of population density is, however, insignificant.

Column 2 considers metropolitan areas. Although qualitatively similar results were obtained, the magnitude of the parameter estimates for the proportions of African and white populations is greater than those in Column 1. In this sense, population group compositions at the sub-place level seem to be more influential in the large cities. Similarly, the

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Table 2 Determinants of school fee

Dependent: log of annual school fee (Rand)						
Sample:	SA	Metro	SA	Metro	SA	Metro
<i>Population group composition:</i>						
Prop African	-0.474 (5.77)	-0.500 (3.66)			-0.412 (4.97)	-0.205 (1.32)
Prop Whites	0.942 (9.04)	1.424 (6.73)			0.674 (6.44)	0.792 (3.57)
<i>Economic factors:</i>						
Ln mean household income			0.171 (11.25)	0.585 (5.19)	0.031 (2.71)	0.213 (2.47)
Av years of schooling			0.154 (22.52)	0.172 (4.17)	0.071 (14.39)	0.084 (2.68)
Unemployment rate			-0.140 (2.94)	-2.179 (5.76)	0.008 (0.22)	-0.631 (2.10)
<i>Former Apartheid departments:</i>						
BOP 2	0.184 (3.37)				0.060 (1.78)	
CISKEI 3	0.114 (0.71)				0.073 (0.46)	
DET 4	-0.434 (10.78)	-0.139 (0.80)			-0.419 (10.45)	-0.234 (1.39)
GZK 5	-0.092 (1.63)				-0.082 (1.58)	
HOA 6	1.654 (18.89)	1.909 (7.44)			1.662 (18.99)	1.815 (7.24)
HOD 7	0.650 (7.52)	0.777 (3.85)			0.620 (7.22)	0.599 (3.01)
HOR 8	-0.130 (1.92)	0.387 (1.96)			-0.113 (1.67)	0.325 (1.69)
KND 9	-0.040 (0.55)	0.066 (0.36)			-0.069 (0.97)	0.006 (0.03)
KZ 10	-0.330 (3.38)				-0.331 (3.35)	
KANGWANE 11	-0.134 (2.97)	0.156 (0.79)			-0.126 (2.80)	0.107 (0.56)
LEB 12	-0.063 (1.52)	-0.369 (1.87)			-0.074 (1.86)	-0.438 (2.25)
QWAQWA 14	0.611 (4.58)				0.564 (4.20)	
TED 15	1.819 (17.69)	2.136 (8.33)			1.865 (18.42)	2.015 (8.05)
TRANSKEI 16	-0.100 (0.95)				-0.087 (0.83)	
VENDA 17	-0.032 (0.33)				-0.050 (0.52)	



*Location types:*

Urban (%)	0.721 (22.60)	0.569 (5.74)	0.901 (17.80)	-0.323 (1.94)	0.535 (16.39)	0.137 (1.12)
Informal (%)	0.568 (10.73)	0.523 (4.79)	0.738 (10.71)	0.563 (3.39)	0.534 (10.69)	0.447 (3.75)
Industrial (%)	0.868 (7.82)	0.761 (3.27)	0.570 (2.72)	-0.503 (1.38)	0.758 (6.57)	0.464 (1.81)
Institutional (%)	0.823 (5.29)	0.902 (3.12)	0.513 (1.99)	0.186 (0.41)	0.520 (3.29)	0.443 (1.59)
Hostel (%)	0.811 (5.31)	0.248 (0.91)	0.055 (0.19)	-0.481 (0.88)	0.682 (4.49)	0.054 (0.20)
Population density	-8.31E-06 (1.72)	-0.00002 (2.01)	-0.0001 (12.94)	-0.00002 (1.77)	-9.27E-06 (2.02)	1.01E-06 (0.13)
R squared	0.6881	0.7939	0.5571	0.6741	0.6934	0.8046
# obs.	18564	1805	18509	1804	18509	1804

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Numbers in parentheses are absolute t values, using robust standard errors with Census subplace clusters. All specifications include district fixed effects, and school type dummies (primary and secondary: combined as the omitted case). For former education departments, schools established under the new department since 1994 are omitted as the benchmark case (new education department: 13).

effects of HOA, HOD and TED are larger than those in Column 1. Hence, it appears that the past apartheid regime affects school fees more significantly in these metropolitan areas than in the country on average. Population composition, however, is highly correlated with income and level of education.

Columns 3 and 4 focus on factors that represent income opportunities. These variables are expected to be significant if the credit market is imperfect. In the country as a whole, the mean household income and average years of schooling (age 20–64) significantly increase school fees, while the unemployment rate significantly decreases school fees. These results are consistent with the predictions of our simple model in Section 2.

In Column 4, the sample is restricted to Johannesburg, Cape Town and Durban. Mean household income, average years of schooling and the unemployment rate significantly affect school fees. The income effect is greater here than that in the country on average. Consistent with the previous findings on population composition in metropolitan areas, income gap correlated with population composition matters more in metropolitan areas than the national average. In contrast, the effects of settlement types become weaker in metropolitan areas.

Finally, Columns 5 and 6 include apartheid-regime and income opportunity factors. Column 5 shows that both factors matter significantly. The magnitude of impacts, however, differ between the two. While population group composition remains as influential as those in Columns 1 and 2, the effects of mean household income, average years of schooling and the unemployment rate become much smaller in magnitude than those found in Column 3. That is, even though financial and labor-market constraints in the current regime seem to be significant,

historical factors originating from the apartheid system (partly correlated with income opportunities) are more significant in the way that they constrain the ability to pay for school quality and the quality of schooling investments in the next generation.

In metropolitan areas (Column 6), however, the effect of African proportion decreases nearly by a half (from  $-0.412$  to  $-0.205$ ) and becomes insignificant, while the effect of average income increases from  $0.031$  to  $0.213$  and is thus significant. Socio-economic factors matter more in these large cities than the country average.

Our results imply that neighborhood factors matter as agents with similar socio-economic backgrounds are likely to be clustered over space. This happens partly because apartheid created inequality in income opportunities (correlated with population groups) and also introduced spatial segregation by population group, and partly because even after the abolition of apartheid, financial constraints became important in residential location choice, which determines access to income and educational opportunities.

#### **4. Conclusion**

This paper examines historical and spatial factors that determine quality education and the community's capacity to finance education in post-apartheid South Africa where apartheid policies had contributed to the spatial segregation of population groups and differential education and income opportunities. Our findings show that both historical constraints as well as financial constraints matter in terms of access to quality education. First, population group compositions created by apartheid (especially proportions of Africans and whites) at subplace

level and the former apartheid departments of education significantly affect school fees, and therefore quality of education. A higher school fee is charged in residential areas with a large proportion of white population. Second, average income, schooling and unemployment rate at the Census subplace level also influence the determination of school fees, which implies the existence of an imperfect credit market.

We also found differences between metropolitan areas and the rest of the country. In metropolitan areas, financial constraints are more important and population composition is less important. This finding is reasonable since migration to cities became unrestricted without legal constraints after the abolishment of apartheid, and thus income mobility is now more dynamic in urban areas. In this process, relatively rich households can move to well-off (that is, formerly white) residential areas to send their children to better schools, which was formerly prohibited. This is happening in the areas surrounding large cities. Therefore, the on-going transition from historically driven location factors to financial constraints (imperfect credit access) is more visible in the metropolitan areas than in the rest of the country. Given that population mobility from poor into well-off areas is limited, however, the government should increase financial and personnel support to disadvantaged locales and schools, targeting specific areas as its progressive subsidy allocation has recently begun to do.

#### 《Data Sources》

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2. Annual School Survey 2002 (National Department of Education)
3. School Register of Needs 1996 (National Department of Education)
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## Convergence over Space and Generations in the Post-Apartheid South Africa

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### 《Abstract》

This paper examines a range of historical and location factors that determine the quality of public school education in post-apartheid South Africa. Empirical analysis shows that population groups are still spatially segregated due to the legacy of apartheid, and given school quality is positively correlated with school fees, quality education is concentrated in formerly white, coloured and Indian schools in areas where the majority is non-African. Even after the abolishment of apartheid, the imperfect credit market has prevented Africans from moving into well-off residential areas where they could access quality education. Historical factors, however, are less important in metropolitan areas where the inflow of population is large. To address this imbalance, financial support to disadvantaged locales and schools should be strengthened.