



Opportunity Hoarding and Elite Reproduction: School Segregation in Post-Apartheid South Africa

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School integration is an important indicator of equality of opportunity and racial reconciliation in contemporary South Africa. Despite its prominence in public and political discourse, however, there is no systemic evidence on the levels and patterns of school segregation. Drawing on the literature on the post-apartheid political settlement and sociological theories of opportunity hoarding, we explain how the small White minority and, to a lesser extent, the new Black middle class monopolized access to South Africa's most prestigious schools following the abolition of de jure segregation in 1994. Using the 2021 Annual School Survey—an administrative dataset covering all South African schools—and the 2019 Trends in International Mathematics and Science Study school survey, we find very high levels of school segregation along racial as well as socioeconomic lines. White students almost exclusively attend former White schools, have little exposure to the low-income Black majority, and are vastly overrepresented in elite public and private schools. We argue that in South Africa and other contexts with under-resourced education systems, elite capture of the few high-performing schools serves to reproduce race and class privilege.

Introduction

Sociological research on school segregation remains heavily focused on Western countries, and the United States in particular (Reardon and Owens 2014). In comparison, research on school segregation in the global South—home to over 85% of the world's school-aged population—remains scarce, although there are reasons to expect high levels of racial as well as socioeconomic segregation here (Gruijters and Behrman 2020). Accordingly, this paper reports on school segregation in contemporary South Africa, a country with a large Black majority and a small, wealthy White minority.

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School segregation is a deeply charged and contested topic in South Africa, which abolished formal racial segregation less than three decades ago. In the democratic, post-apartheid South Africa, school integration is seen as a way to promote social justice and disrupt the reproduction of society along racial lines. Despite its symbolic and sociopolitical significance, however, no concerted efforts were made to promote or enforce school desegregation, and there is no nationally representative evidence on the extent to which schools have desegregated.

Against this background, our study seeks to fulfill four main objectives. First, we assess the nature and extent of multi-group and pairwise segregation at different levels of geographic aggregation. In doing so, we assess how the apartheid legacy of extreme residential segregation affects current patterns of school segregation. Second, we examine and visualize the current patterns of racial segregation and diversity in schools that were designated as “Asian/Indian,” “Black African,” “Coloured,” and “White” under apartheid. Third, we assess the degree of racial diversity in the country’s most elite public and private schools, which serve as the gateway to high-status occupations. Fourth, we investigate the level of between school socioeconomic segregation, as well as its relationship with racial segregation. In doing so, our study makes a theoretical, methodological, and empirical contribution to the international scholarship on school segregation.

Theoretically, we adapt Tilly’s framework of opportunity hoarding (1998) to “bifurcated” education systems in the global South, where a small number of “good” schools exist alongside many low-performing, under-resourced schools. We argue that elite capture of high-performing educational institutions is a common and effective method of reproducing race and class privilege in such contexts. In South Africa, the marketization and decentralization of the school system, the apartheid legacy of residential segregation, and the vast differences in resources between racial groups facilitated this process, resulting in extremely high levels of racial and socioeconomic segregation between schools.

Methodologically, we introduce the *segplot*, a new and powerful tool for visualizing patterns of multigroup segregation. Segplots provide an intuitive illustration of segregation between schools or other units, showing both the extent of unevenness and its qualitative patterns. Building on earlier work by Seiler and Jann (2019), we also develop a novel approach to account for covariates in segregation analysis. This method is more flexible than previous solutions because it allows for continuous as well as categorical covariates.

Empirically, we employ previously unused, highly detailed administrative and survey data to provide the first nationally representative analysis of school segregation in South Africa, extending the predominantly Western scholarship on educational opportunity hoarding and school segregation to this important Southern context. Our findings contradict prevailing narratives of integration and “de-racialization” in South African schools, showing that racial segregation remains exceptionally high. Socioeconomic segregation is also exceptionally high, but we show that racial segregation is only partially driven by racial differences in wealth.

In the following sections, we outline our theoretical framework and provide some historical context on school segregation in South Africa.

Theoretical Framework

Tilly (1998) sees opportunity hoarding—where members of a particular social group seek to maintain or improve their status by excluding others from scarce resources—as one of the main drivers of between-group inequality, including racial inequality. In the case of school segregation, the “hoarded” resource is access to the most well-resourced and high-performing schools and the peer networks that come with attending them. Educational opportunity hoarding therefore posits a link between school segregation and the quality of schooling obtained by different groups (Hanselman and Fiel 2017).

Opportunity hoarding is a micro-level process that does not require political power or centralized coordination. Tilly describes various strategies that dominant groups use to establish

and maintain control over social resources, such as monopolizing information, employing institutional power, and promoting beliefs and practices that legitimate unequal access. In the educational domain, test scores, school fees, and other admissions criteria—such as language proficiency—are often used as practical tools of exclusion (Diamond and Lewis 2022). Schools with high concentrations of disadvantaged learners generally have lower levels of financial and sociocultural resources, experience negative peer effects, and may find it difficult to attract and retain the most talented teachers. As a result, segregated schools tend to reinforce and perpetuate the unequal distribution of educational resources (Reardon and Owens 2014).

Legitimation devices, which justify practices that result in structural advantages for privileged groups, play an important role in opportunity hoarding. In the American context, narratives of “colorblind racism”—especially the idea of meritocratic selection—are an important legitimation device for continued school segregation in the post-civil rights era (Lewis and Diamond 2015). Racial opportunity hoarding in education is therefore highly compatible with Bonilla-Silva’s (2001) conceptualization of the “new racism” in the United States, where Whites overwhelmingly embrace diversity and disavow overt racist statements but reject policies that threaten their race-based privileges. Comparable observations have been made in post-apartheid South Africa. Nationally representative survey data show that 86% of South Africans (strongly) support racial integration in schools, and 77% (strongly) support socioeconomic integration. The corresponding figures for White respondents are 64.3 and 52% (see Appendix Table E1 for more details). As we will show, however, these ostensibly favorable attitudes do not preclude educational opportunity hoarding by race and class.

Tilly argues that individuals and groups who engage in opportunity hoarding do not necessarily seek to create unequal outcomes. Instead, inequality emerges as a by-product of the pursuit of rewards from sequestered resources—in our case, parents seeking an educational advantage for their child. We argue that the ability of high-status groups to hoard educational opportunities—and therefore the degree of between-school segregation—is primarily determined by four factors: (1) the relative differences in power and resources between groups; (2) the extent to which groups are spatially separated from one another; (3) the extent to which schools vary in cost, resources, and prestige; and (4) the degree to which the institutional environment facilitates opportunity hoarding. These four drivers are all exceptionally pronounced in the South African context, as we explain below.

Between-Group Differences in Power and Resources

Contemporary South Africa remains characterized by a profound social and economic distance between racial groups. “Race” is an important marker of social identity and South Africans’ social worlds and racial prejudice and discrimination remains prevalent (Seekings 2008). Social closure by race contributes to opportunity hoarding because it facilitates collective action to maintain in-group privileges (Fiel 2015). Most importantly, however, White opportunity hoarding in education is facilitated by the extreme racial inequality in socioeconomic resources: median White household wealth is 23 times higher than median Black household wealth and 16 times higher than median Coloured household wealth (Mbewe and Woolard 2016: 12). There are also high levels of wealth inequality within the Black population, however, as a small Black middle class has emerged alongside the poor Black majority (Southall 2016; The World Bank 2018). Theories of homophily suggest that segregation is likely to be particularly pronounced between groups that differ along multiple dimensions—high levels of racial inequality in wealth are therefore expected to reinforce between-school racial segregation, especially between rich White and poor Black children.

Spatial Separation between Groups

Because most children attend schools in their local area, spatial segregation between groups facilitates educational opportunity hoarding, especially if it maps onto variation in school quality (Diamond and Lewis 2022). Conversely, schools in integrated neighborhoods are less likely to

be “captured” by dominant groups. In apartheid South Africa, racial groups were allocated to different areas, with the most attractive zones reserved for Whites. Residential segregation is still very high in South Africa, and many “good” schools remain located in predominantly White, middle-class neighborhoods, complicating efforts to desegregate them (Spaull 2019; Statistics South Africa 2016).

Between-School Variation in Cost, Resources, and Prestige

Hoarding educational opportunities is particularly critical for status attainment when good schools are scarce and there are large disparities in school quality and reputation (Hanselman and Fiel 2017; Sattin-Bajaj and Roda 2020). Class-based opportunity hoarding is reinforced by privatization, which makes school quality a direct function of parents’ ability to pay (Grujters, Alcott, and Rose 2021). In South Africa’s bifurcated and semi-privatized education system, there are vast differences in school resources and performance, and quality is closely related to cost (Ndimande 2016). As an illustration, in 2018, the top 200 high schools in South Africa produced more students achieving a distinction in mathematics than the remaining 6600 schools combined (Spaull 2019: 1). The most prestigious and desirable schools—almost exclusively former White schools—are mainly funded through fees, which enable them to hire additional specialist teachers and maintain expensive facilities such as sports grounds and computer labs. Most South African parents are unable to afford such fees, however, and enroll their children in “no-fee schools,” which often lack adequate resources and are low-performing (Reddy et al. 2012).

The Facilitating or Constraining Role of the Institutional Environment

The South African policy environment is exceptionally conducive to opportunity hoarding. School governing bodies enjoy nearly complete autonomy in their admissions policies, fee levels, and other school-level policies, and there is no legal requirement or political initiative to desegregate schooling—a topic we return to in the next section.

Historical Background: Education Policy in South Africa

In this section, we briefly outline the history of educational policy in South Africa and discuss implications for school segregation by race and class.

Education under Apartheid (1952–1990)

The apartheid regime divided the South African population into four hierarchically ordered categories: Whites, Asians/Indians, Coloureds, and Black Africans, and schools as well as residential areas were segregated accordingly. The schools designated for each of the four racial groups received vastly different resources and learned from different curricula (Soudien 2016). Schooling for Black Africans, in particular, was of inferior quality and designed to “ensure the subordinate position of Africans in the South African social and political hierarchy” (Nkomo 1981: 127). Black schools were overcrowded, under-resourced, and geared toward preparing pupils for manual labor (Fataar 2010). White schooling, on the other hand, was generally of a high standard, although a hierarchy of quality and prestige also existed among White schools (Jansen and Kriger 2020). Most prestigious were the single-sex boarding schools established by nineteenth-century British missionaries on the English upper-class model. Education was a particularly contested space during apartheid, and protests against Afrikaans-medium instruction triggered the 1976 Soweto uprising that reinvigorated the liberation struggle and foreshadowed the end of *de jure* apartheid in 1994 (Fataar 2010).

The Transition Period (1991–1996)

The end of Apartheid came about gradually through a political settlement negotiated by the National Party (NP), the African National Congress (ANC), and other interest groups. The overall result of the negotiation process was a compromise in which the White minority was allowed to

retain most of the economic advantages it had acquired under apartheid, in exchange for ceding political power (Padayachee and Niekerk 2019). This broader political settlement was reflected in the educational reforms of the transitional period. In essence, the two parties disagreed about the extent to which the White minority should be able to maintain its privileged position—including access to the best public schools—in the democratic era.

The eventual compromise required schools to accept learners from all backgrounds, and government funding was equalized across all public schools. This entailed a considerable drop in funding for (former) White schools, raising concerns about a mass exodus of White students to the private sector. To compensate for the shortfall, it was decided that schools would be permitted to charge fees to complement government funding. In the 1996 South African Schools Act, school governing bodies (SGBs) consisting of parents and teachers received a broad mandate to set fee levels, hire teachers, decide on their school's language policy, and determine the school's admission criteria (Karlsson 2002). The introduction of school fees and the strengthening of SGBs were two crucial concessions to the White minority. By setting school fees and other admissions criteria, White parents and teachers—who control SGBs in many former White schools—can shape the sociodemographic composition of “their” schools, (Jansen and Kriger 2020). In practice, the educational policies forged in the transition era therewith enabled the White minority to continue hoarding access to the most prestigious and well-resourced schools.

Education in the Democratic Era (1997–Present)

Post-apartheid South Africa continues to struggle with high levels of poverty, inequality, and unemployment. The legacy of apartheid remains evident in patterns of racial inequality as well as spatial segregation. Although a new Black middle class has emerged—especially in metropolitan areas—most of the Black population lives in rural areas or urban townships, where standards of living have barely improved.

Equalizing access to educational opportunities and outcomes across racial and socioeconomic groups has been a major goal of successive post-apartheid governments, but progress has been slow and uneven (Spaull and Jansen 2019). Government spending on basic education in the democratic era has been decidedly pro-poor, and enrollment rates have increased, but this has barely improved academic achievement (Seekings and Natrass 2005). Particularly in former Black schools, the quality of teaching and learning remains persistently low, as evidenced repeatedly by international learning assessments. Of the 39 countries that participated in the 2019 Trends in International Mathematics and Science Study (TIMSS) survey, South Africa ranked last in science achievement and second to last in mathematics (Reddy et al. 2021: 3). Large discrepancies in resources and achievement levels contribute to intense competition over access to a small number of “good” schools, which are widely seen as the gateway to achieving a decent standard of living.

In this competitive environment, the interests and demands of the new Black middle class are broadly aligned with those of the White minority (Southall 2016). A mutually beneficial middle-class settlement emerged, in which children from more affluent black African, Indian, and Coloured backgrounds gained access to prestigious former White schools. By admitting a limited number of higher-income students of color while continuing to exclude the low-income majority, these schools could claim to be integrated (Jansen and Kriger 2020; Ndimande 2016). This type of class-based opportunity hoarding arose directly from educational policies agreed during the transition period, which “allowed the middle class to secure control of the historical ex-white school sector” (Badat and Sayed 2014: 134). The arrangement was convenient to the new Black political elite, whose own children often attended these schools.

Privileged groups employed a range of strategies and legitimization devices to maintain de facto control of desirable schools. Racial and socioeconomic discrimination in school admissions was explicitly prohibited by the 1996 constitution, and the Schools Act states “No learner may be refused admission to a public school on the grounds that his or her parent is unable to pay or has not paid the school fees.” The desegregation of primary and secondary schools was never

mandated or enforced, however. Unlike in higher education, where quotas and affirmative action policies were introduced after the democratic transition, school desegregation is considered a matter of individual school policy, and information on the racial composition of schools is not publicly available. Prestigious former White schools therefore have access to a variety of formal and informal means of “maintaining educational standards” that sustain a middle-class, majority-White student body (Jansen and Kriger 2020). The fee exemption clause, which was designed to prevent income-based discrimination in access to public schooling, is effectively circumvented by most fee-paying schools. Interviews, tuition fees, and opaque admission procedures are used to screen out applicants who may be unable to pay fees, and school catchment areas often deliberately exclude townships and other low-income zones. As a result, only a small number of students in former White schools receive fee exemptions (Spaull 2019: 8). Moreover, a small number of Afrikaans-medium schools continue to exclude the Black majority on the basis of language.

Parental behavior is another important determinant of schools’ sociodemographic composition: rapidly diversifying schools often experience White flight and a corresponding decline in status. Several studies have documented efforts by White as well as middle-class Black parents to resist attempts to increase racial and socioeconomic diversity in schools (Jansen and Kriger 2020; Soudien and Sayed 2003). Private (“independent”) schools provide an alternative option for middle-class parents and have increased their share of enrollments to around 5%.

Empirical Evidence: School Segregation in Contemporary South Africa

Before the democratic transition in 1994, almost all South African children attended schools designated for their racial group. Much has changed since then and the process of desegregation has attracted considerable academic interest. Studies that look at parental preferences and school choice (the demand side) and school admission and diversity policies (the supply side) are particularly relevant to our research questions. The school choice literature describes the emergence of a “quasi-market,” in which access to high-performing schools—mainly the former White, Indian, and Coloured schools—has become highly contested and competitive. Parents go to great lengths to gain admission to these schools, and many children travel large distances to attend schools outside their area of residence. Race, socioeconomic status (SES), and geography all play an important role in this process: poor Black families often lack the resources to access high-performing schools, which are usually located far from their neighborhoods (Hunter 2019). Conversely, high-status schools focus on attracting learners whose families can pay the fees and fit within the “ethos” of the school (Hunter 2019; Jansen and Kriger 2020). Ethnographic studies have shown how Black students attending high-status schools are expected to assimilate into a predominantly White school culture (Carter 2012; Matentjie 2019).

This research has also shown how former White and Indian schools strategically deployed fees, catchment areas, and other admissions criteria to influence the racial and socioeconomic composition of their student body, in line with the educational opportunity hoarding hypothesis. At the same time, qualitative studies have documented efforts by parents of color to overcome such barriers, a phenomenon that is described as “opportunity prying” by Lyken-Segosebe and Hinz (2015). For example, Hunter (2019) described how middle-class Black parents in Durban sought to abolish zoning regulations that excluded their children and used political connections to gain access to elite former White schools. Jansen and Kriger (2020) analyzed the admissions policies of 30 former White schools in Cape Town. Although schools are legally forbidden from selecting applicants based on their race or SES, schools used a combination of “invisible” or “subtle” mechanisms, including zoning policies, admission tests, and other entrance requirements, to ensure that the pupils they admitted would be able to afford the substantial fees. The extent to which schools were able to practice social closure and exclusion depended on their location and reputation. The city’s most prestigious schools were mostly located in affluent suburbs and

remained majority White after the abolition of apartheid, although most of them admitted a substantial minority of affluent children of color. On the other hand, the less prestigious former White schools, which had often served the White working class under Apartheid and were located in more affordable neighborhoods, frequently experienced outflows of White students and became primarily Black or Coloured. This suggests that even among the relatively higher-performing former White schools, there is a hierarchy of quality and reputation, which correlates with a school's racial and social composition (Spaull 2019).

Although the aforementioned case studies provide a rich, micro-level picture of the desegregation process in former White schools, quantitative evidence of contemporary segregation remains very limited. The government does not publish statistics on the racial composition of schools, and the few relevant academic studies rely on data from the early 2000s that is not nationally representative. In line with the qualitative studies described above, these studies reported large-scale migrations of Black, Indian, and Coloured students into formerly White schools, but not the other way around. For example, in 2006, a striking 99% of White children were enrolled in public schools that had been designated "White" under apartheid (Amsterdam, Nkomo, and Weber 2012). There was more movement among other racial groups, mostly to formerly White schools. However, the aggregate racial composition of former White schools likely masks substantial between-school segregation. As discussed below, former White schools did not integrate evenly: many became entirely Black, while others remained predominantly White. To understand the extent of between-school segregation, therefore, we need to use indicators of exposure or unevenness. The following section explains how we carried out the first nationally representative, micro-level analysis of school segregation by race and class in the South African context.

Methods

Data

The first dataset we use for this study is the 2021 Annual School Survey from the Department for Basic Education (DBE), an administrative school census covering all public and private primary and secondary schools. Merging the Annual School Survey data with the School Master List, we create a record of each South African school's location, type (public or private), apartheid classification, and current racial composition. The DBE derives information on a school's racial composition from individual learner records, which, in turn, are based on parental reports when the child is first registered in a school. In our analyses, we examine segregation in regular public or private primary and secondary schools (grades 1–12), which enrolled 13.3 million students in 2021. Excluded from the study are a few special educational needs schools and vocational colleges as well as a small number of students (0.28%) whose racial category is coded "Other." We use a second dataset, the 2019 TIMSS, for the analysis of socioeconomic segregation and its intersection with racial segregation. TIMSS is a nationally representative school survey of 20,829 Grade 9 students in 521 schools (Reddy et al. 2021). We access restricted data from this survey that include measures of students' self-reported racial classification as well as their socioeconomic background. To our knowledge, these are the only two South African datasets with information on students' racial backgrounds, and neither has been previously used to analyze between-school segregation.

Measures

The Annual School Survey and the TIMSS both use the census classifications "Asian/Indian" (hereafter referred to as "Indian"), "Black African" (hereafter, "Black"), "Coloured," and "White" to classify population or "racial" groups¹. Although we acknowledge the fraught and socially constructed nature of these categories, especially in the South African context, we employ them in this study because they are a widely practiced form of self-identification in South Africa, and because they remain associated with vastly different levels of wealth and access to public

services, including education (Seekings 2008). In the 2021 Annual School Survey, 87.2% of children were classified as Black, 7.5% as Coloured; 3.8% as White, and 1.5% as Indian. To calculate the SES index, we used information on a set of nine home assets—such as a computer, water heater, and internet connection—as well as the number of books at home and the education level of both parents, as reported by the students. The SES score for each student is a weighted average of the SES items, with the weights determined by multiple correspondence analysis.

At the school level, we distinguish between schools classified as White, Coloured, Indian, and Black under apartheid, and we identify the most elite public and private schools in the country—as described in the next section.

Analytical Approach

School segregation is typically measured as either *exposure* or *unevenness* (Massey and Denton 1988). Indices of exposure (or isolation) measure the extent to which students are exposed to peers from a different population group in their schools. For example, the White–Black exposure index measures the average proportion of Black students that White students experience in their school. Indices of unevenness, on the other hand, measure the extent to which a student population is unevenly distributed across schools, relative to their proportions in the population of interest. Reardon and Firebaugh (2002) conclude that Theil’s entropy index (H) is the most conceptually and mathematically satisfactory index for assessing multi-group segregation.

Exposure of group X to group Y is defined as

$${}_xP_Y = \sum_{s=1}^S \frac{n_{X|s}n_{Y|s}}{N_Xn_s} \quad (1)$$

where $n_{X|s}$ and $n_{Y|s}$ are the number of students in school s of groups X and Y, respectively, N_X is the total number of students of group X, and n_s is the total number of students in school s . In general, ${}_xP_Y \neq P_X$, as the index depends on the share of students of groups X and Y. The quantity ${}_xP_X$ is known as the isolation index for group X.

To define the H index, we first define the *adjusted local segregation* of each school s as

$$SCI_s = \frac{1}{E(\mathbf{p}_g)} \sum_{g=1}^G p_{g|s} \log \left(\frac{p_{g|s}}{p_g} \right) \quad (2)$$

where $p_{g|s}$ is the proportion of racial group g in school s , and p_g is the overall proportion of racial group g . The function $E(\bullet)$ is defined as the entropy of a distribution:

$$E(\mathbf{p}_g) = \sum_{g=1}^G p_g \log \left(\frac{1}{p_g} \right) \quad (3)$$

The adjusted local segregation measures how far a school’s racial group distribution deviates from the overall racial group distribution. A weighted average of ALS_s , where the weights are given by the school size, defines the H index:

$$H = \sum_{s=1}^S p_s ALS_s \quad (4)$$

where p_s is the proportion of total enrollments in school s .

Indices of exposure and unevenness reflect different conceptualizations of segregation and may result in divergent conclusions (Reardon and Owens 2014). We therefore compute both the

exposure indices for each group and Theil's H as an overall index of multi-group segregation. Although we define all indices based on the full population, it is also possible to calculate these indices on subsets of the population, such as the student population in former White schools only.

Although indices such as H provide a useful summary of the overall level of segregation, they reveal nothing about the underlying *pattern* of segregation. For example, a school segregation index of 0.3 may result from a few highly segregated schools or from moderate levels of segregation in all schools. Similarly, multi-group segregation may be more pronounced between some groups than others. We therefore develop and apply a new method for visualizing patterns of multigroup segregation, which we call a *segplot* (see also [Elbers and Gruijters 2024](#)). The *segplot* methodology is explained in more detail in [Appendix A](#) and is publicly available as an R-package.

In addition to desegregation, policymakers and school authorities may strive to improve diversity in schools. In the South African context, where a large Black majority coexists with much smaller racial minorities, segregation and diversity mean different things. We measure diversity using the entropy defined in equation (3). The entropy is maximized when each population group g is of equal size ($p_g = 1/G$ for all g) and minimized at zero when a school contains only one racial group.

Theories of opportunity hoarding predict that privileged groups will seek to monopolize access to the best schools. Former White schools remain the most prestigious and well-resourced schools in South Africa, followed by former Indian and Coloured schools. In addition to overall segregation, we therefore calculated the average local segregation (2) and diversity index (3) by apartheid classification. Even among the former White schools, a clear prestige hierarchy exists, however, which is reflected in the fees they charge. We identified the most elite public and private schools based on 2021 fee levels² and analyze their racial composition.

We also assess the degree of socioeconomic (or class-based) segregation between schools, as well as the relationship between socioeconomic and racial segregation. First, we use the intra-class correlation coefficient (ICC) of SES to calculate the level of between-school socioeconomic segregation. Second, we adapt a technique developed by [Seiler and Jann \(2019\)](#) for the study of social mobility to the case of school segregation, which allows us to measure the extent to which racial segregation between schools is explained by socioeconomic segregation. The technique is based on the idea that the H index can be embedded into a regression framework, enabling us to control for additional variables (see [Appendix B](#) for further details). Third, we assess the extent to which middle-class White students are exposed to (1) working-class White students, (2) middle-class Black students, and (3) working-class Black students (and vice versa) using the exposure index.

Results

Segregation as Exposure

We start by conceptualizing school segregation as the extent to which children are exposed to peers who belong to different racial groups in their schools. Exposure indices measure the average school composition experienced by the average student from a given racial group. It is important to remember that exposure indices are influenced by the relative share of each group in the population. For example, because Black students constitute 87.2% of the total student population, their average exposure to other Black students (also referred to as the Black isolation index) cannot be below this figure. The White isolation index, on the other hand, can theoretically be as low as 3.8%. In a perfectly integrated system, where each school's racial distribution equals the population's racial distribution, the exposure indices would equal the population shares.

In 2021, the average White student attended a school that was 68.5% White, 3.3% Indian, 8.5% Coloured, and 19.6% Black (see [table 1](#)). Conversely, the average Black student attended a school that was 0.9% White, 0.7% Indian, 2.0% Coloured, and 96.4% Black. The Indian isolation index was 41.6%, and the Coloured isolation index was 71.4%.

Table 1. Exposure Indices

Student background	Exposure to White	Exposure to Indian	Exposure to Coloured	Exposure to Black	Population share
White	68.5	3.3	8.5	19.6	3.8%
Indian	8.6	41.6	5.8	44.0	1.5%
Coloured	4.3	1.1	71.5	23.0	7.5%
Black	0.9	0.7	2.0	96.4	87.2%

Source: based on the 2021 Annual School Survey data. **Note:** Isolation indices printed in bold.

South Africa's demographic composition—in which White, Coloured, and Indian children form a small minority compared to the large Black majority—means that even a relatively modest inflow of Black, Coloured, or Indian children into former White schools can create a dramatic shift in exposure-based indices of segregation, when viewed from the minority's perspective. In the next section, we observe that Black children constitute 54% of pupils in former White schools. However, this has not led to equivalent shifts in White–Black exposure because the distribution of Black students across these former White schools is uneven and largely restricted to a specific group of such schools, many of which are now predominantly Black.

Segregation as Unevenness

Conceptualizing segregation as the uneven distribution of students across schools confirms that overall segregation levels in South Africa are very high. [Figure 1](#) shows the racial composition of all South African schools. In the plot, the reference population—the racial distribution of all students—is shown as the rightmost bar, which can also be interpreted as the distribution of a hypothetical, perfectly integrated school. Each vertical line in the graph represents one school, ordered according to its adjusted local segregation index, with the most segregated schools on the left of the graph and the most integrated—those most closely resembling the reference population—on the right. The national-level H-index is 0.74: a high value given that H can range between 0 (each school perfectly matches the reference distribution) and 1 (each school contains only one racial group). [Figure 1](#) reveals that the current situation in South Africa's schools more closely resembles the latter scenario. A large number of schools are Black only, and many White and Coloured students are enrolled in majority-White and majority-Coloured schools, respectively.

However, it could be argued that it is unrealistic to expect all schools to represent the national reference population because that population is neither evenly distributed across provinces and municipalities, nor across neighborhoods within municipalities. For example, most Coloured people live in the Western and Northern Cape provinces, and KwaZulu Natal has a large Indian community. Arguably, therefore, it is more realistic to expect schools to reflect the population composition of their local area. On the other hand, the clustering of certain groups in areas with good schools might itself be considered a form of opportunity hoarding ([Diamond and Lewis 2022](#); [Lyken-Segosebe and Hinz 2015](#)). This is particularly true in South Africa, where the spatial distribution of racial groups still reflects the apartheid zoning regulations, which assigned the most attractive areas to Whites.

To address the question of the appropriate reference group, [table 2](#) shows a decomposition of the total H-index into the contributions of four different geographic levels of aggregation. By moving from higher to lower levels of aggregation, we can assess the extent to which overall school segregation is a function of geographic segregation ([Fischer et al. 2004](#)). The first contribution is the differential distribution of racial groups across provinces. This factor accounts for almost a third of the total national-level segregation. The second contribution further adjusts for the differential distribution of racial groups across municipalities within provinces, but this contribution is fairly minor. The largest contribution (36.6%) to total segregation is made by “urban” segregation,

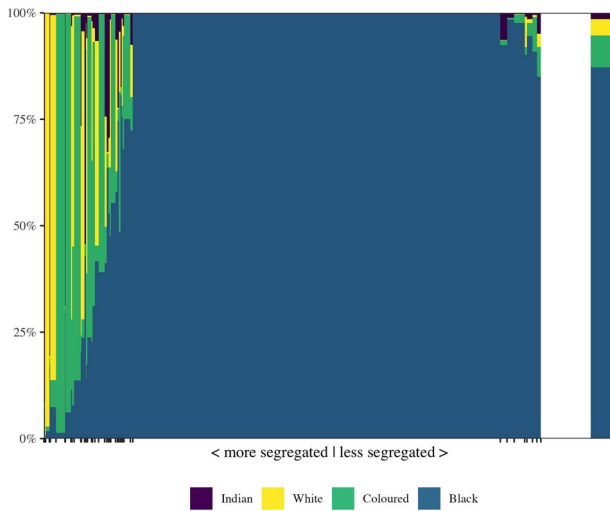


Figure 1. Segregation plot (segplot) of all South African schools ($H = 0.74$). Note: Based on the 2021 Annual School Survey. Compression has been applied as described in [Appendix A](#), retaining 97.8% of segregation information. The vertical lines represent schools or groups of schools, ranked by their adjusted local segregation scores. The single bar on the right represents the population distribution. Please refer to [Appendix A](#) for a more detailed description of the segplot methodology.

Table 2. Geographic Segregation and School Segregation

Total H-index	0.738	100%
Segregation between provinces	0.247	33.5%
Segregation between municipalities within provinces	0.094	12.8%
Segregation between wards within municipalities	0.270	36.6%
Segregation between schools within wards	0.127	17.1%

Source: based on the 2021 Annual School Survey data

which refers to the differential distribution of racial groups across wards *within* municipalities. Lastly, segregation between schools *within* the same ward—the smallest geographic unit—also makes a comparatively minor contribution. These results suggest that residential segregation, especially at the municipal level, is a major contributor to school segregation. This does not necessarily imply, however, that school segregation would be reduced if geographic segregation were to decrease. Even in relatively diverse urban areas, we observe high levels of school segregation, and intra-ward segregation might increase if communities became more diverse.

[Table 2](#) shows that even when the differential distribution of racial groups across provinces and municipalities is accounted for, the adjusted H-index remains at 0.397 ($=0.738 - 0.247 - 0.094$).

Pairwise Measures of Segregation

In the previous section, we focused on the multigroup H-index, which involves all four racial groups. Intuitively, we would not expect all groups to be equally segregated from each other. [Figure 2](#) addresses this point by computing all pairwise H-indices for the eight largest metropolitan areas. For reference, the multigroup indices are shown at the top, and black dots represent the averages across all 212 of the country's municipalities.

[Figure 2](#) shows that segregation in large metropolitan areas is usually higher than in the rest of South Africa, often substantively so. It also demonstrates that segregation is highest between White and Black or Coloured children, both at the national level and in the large metropolitan

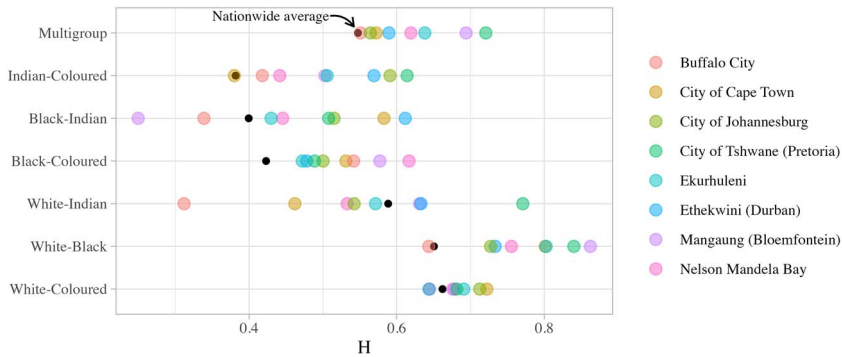


Figure 2. Pairwise measures of between-school segregation

municipalities. The average Black–White segregation index across all municipalities is 0.65, with particularly high values observed in Mangaung (0.86), Ekurhuleni (0.84), and Tshwane (0.80). In Mangaung, this translates to 216 out of 259 schools (83%) with zero White students, 95% of whom attend just twenty different schools that are 75% White on average (see Appendix Figure C1 for the respective segplots). To put this in perspective, the highest levels of White–Black segregation observed in the United States are 0.66 (Milwaukee), 0.62 (Chicago), and 0.61 (Cleveland)³. In comparison, the Indian–Coloured, Black–Indian, and Black–Coloured indices are all substantially lower. This suggests that the high levels of segregation observed in South Africa are to a large extent driven by the segregation of White children from all other groups.

School Segregation and School Quality

Theories of educational opportunity hoarding assume a relationship between school segregation and school quality, whereby students from privileged groups cluster in the most well-resourced and prestigious schools (Hanselman and Fiel 2017). In contemporary South Africa, a school’s apartheid-era classification remains a strong proxy for its overall prestige and quality. Most former White schools are sought-after, well-resourced schools, while most former Black schools remain under-resourced and low-performing, to the extent that many observers speak of a “bifurcated” or “two-tiered” system (Reddy et al. 2012). As an illustration, 87% of former White schools had a library in 2014, compared to only 35% of former Black schools (Spaull and Pretorius 2019: 163). There are similar disparities in teacher knowledge, class sizes, and other common indicators of school quality (Spaull 2019). To analyze the link between school segregation and the quality of education obtained by different groups, we therefore assess the degree of racial segregation between and within former White, Black, Indian, and Coloured schools.

Since the end of apartheid, substantial shifts have occurred in the aggregate racial composition of former White, Indian, and Coloured schools⁴ (see table 3). Black students now constitute the majority in former Indian schools (73%) as well as former White schools (54%). Indian (3.6%) and Coloured students (12.5%) are also well represented in former White schools, relative to their share of the overall population. In contrast, former Black African schools, many of which are located in townships or rural areas, remain almost exclusively Black (98.8%). It is also noteworthy that almost all White students are enrolled in former White schools, which is indicative of successful opportunity hoarding. However, these aggregate figures say little about the degree of segregation or diversity *within* categories of schools as defined by their apartheid classification, because they do not show how students are distributed across schools.

Figure 3 visualizes patterns of segregation among former White, Indian, Coloured, and Black schools. When considering the former White schools (the top-left quadrant) it is immediately clear that the racial groups are not evenly distributed: some former White schools have turned

Table 3. Aggregate Racial Composition of Schools, by Apartheid Classification

	Current % White	Current % Indian	Current % Coloured	Current % Black
Former White schools	29.4	3.6	12.5	54.4
Former Indian schools	0.5	23.3	3.2	73.0
Former Coloured schools	0.2	0.3	66.3	33.2
Former Black schools	0.5	0.2	0.5	98.8

Source: based on the 2021 Annual School Survey data

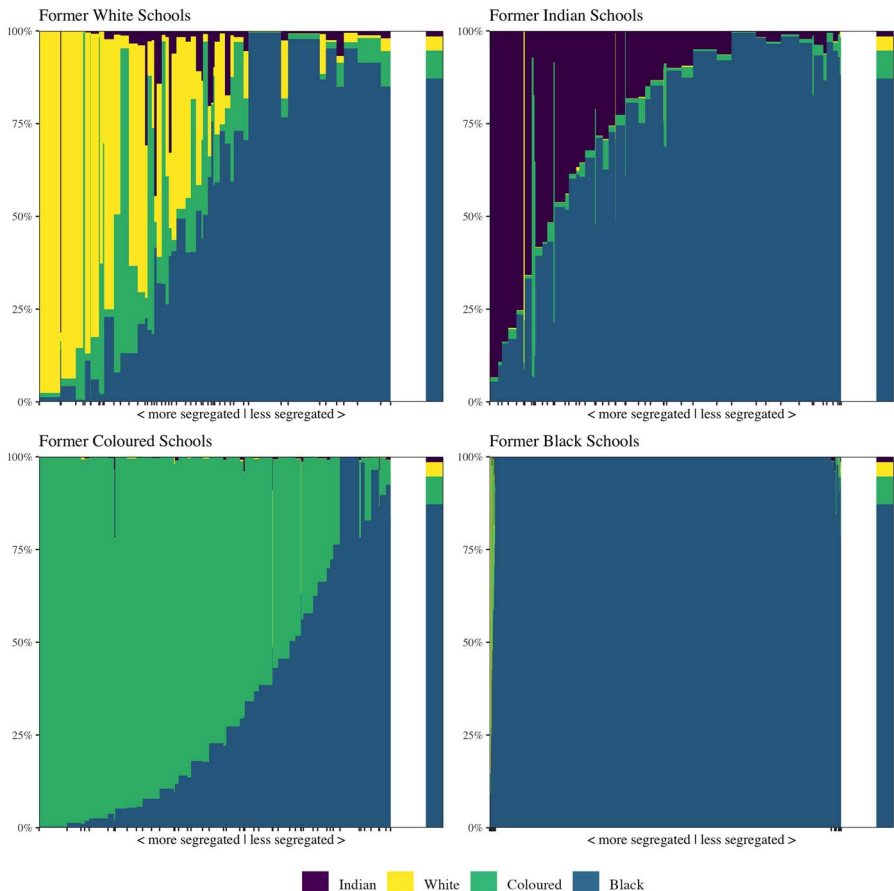


Figure 3. Segregation plot (segplot), by apartheid classification. Note: Based on the 2021 Annual School Survey. Compression has been applied as described in Appendix A, retaining between 96.3 and 99.2% of segregation information. The vertical lines represent the schools or groups of schools, ranked by their adjusted local segregation scores. The single bar on the right of each graph represents the overall population distribution across all schools. Please refer to Appendix A for a more detailed description of the segplot methodology.

almost exclusively Black, others are mixed to various degrees, and a few remain almost exclusively White. Uneven racial distributions can also be observed in former Coloured and Indian schools, with some of these remaining predominantly Coloured or Indian.

Table 4. Local Segregation and Diversity, by Apartheid Classification

	Total schools		Local segregation (ALS)		Diversity (E)
	Number	% ^a	Average per school	Aggregate (%) ^a	Average per school
Former White	1733	10.1	2.0	26.4	66.6
Former Indian	469	2.9	1.7	5.9	43.9
Former Coloured	1455	7.8	3.0	29.7	41.5
Former Black	12,922	49.5	0.3	20.1	4.8

Source: Based on the 2021 Annual School Survey data ^aThese figures do not add up to 100% because they exclude schools established after the end of apartheid in 1994, as well as private schools.

These patterns are reflected in the average local segregation (ALS) index per school shown in table 4. The ALS index is highest for former Coloured schools, followed by former White and former Indian schools, and lowest for former Black schools. Weighting the ALS by school size allows us to compute the total contribution of that school toward the H index (see equation 4). Despite constituting only 10% of all schools, former White schools contribute 26% to the total segregation index H. Former Indian schools (2.9% of all schools) contribute 6%, and former Coloured schools (7.8%) contribute 30%. In comparison, former Black schools contribute less to segregation, because—being almost exclusively Black—they more closely resemble the racial distribution of the population.

In the South African context, where Black children constitute 87% of the population, schools face a trade-off between representativeness and racial diversity: a school that perfectly represents the national population would not be particularly diverse, and vice versa. As discussed previously, schools may seek to be racially diverse rather than to be representative of the population. When looking at the diversity index (table 4) instead of the ALS, a very different picture emerges. Former White schools are the most racially diverse, on average ($E = 66.6$), followed by former Indian ($E = 43.9$) and Coloured schools ($E = 41.5$). In former Black schools, on the other hand, there is almost no racial diversity ($E = 4.8$). It is important to remember, however, that these averages mask substantial variation between schools (see figure 3).

In summary, our findings show that almost 30 years after the end of apartheid, former White schools are the most racially diverse, but integration has been uneven, and White and Indian children remain strongly overrepresented in these schools. This is in line with theories of racial opportunity hoarding, which suggest that the mechanisms of opportunity hoarding and exclusion can adapt to changing external circumstances and reproduce historical patterns of inequality (Lewis and Diamond 2015).

We conducted a further test of the educational opportunity hoarding hypothesis by looking at the racial composition of South Africa's most elite schools. Even among the generally well-resourced former White schools, a clear prestige hierarchy exists, headed by a select number of elite public and private schools. Elite schools are an important tool of upper class (re)production (Reeves et al. 2017), and their accessibility to children from different backgrounds has important implications for social and racial stratification. South Africa maintains a tradition of prestigious boarding schools that have trained the next generation of political, economic, and cultural elites for centuries. Theories of opportunity hoarding suggest that powerful elites will seek to monopolize access to these schools and the socioeconomic opportunities they provide at all costs.

In both the public and private sectors, there is a strong association between a school's perceived prestige and the fees it can charge (Jansen and Kriger 2020). In turn, higher fee income enables elite schools to invest in teaching staff and facilities. We therefore identified the 30 most elite public and private schools by their 2021 fee levels. Fees for the 30 elite public schools—which were exclusively former White schools—ranged from 30,000 to 60,000 ZAR (~2000–4000 USD) per

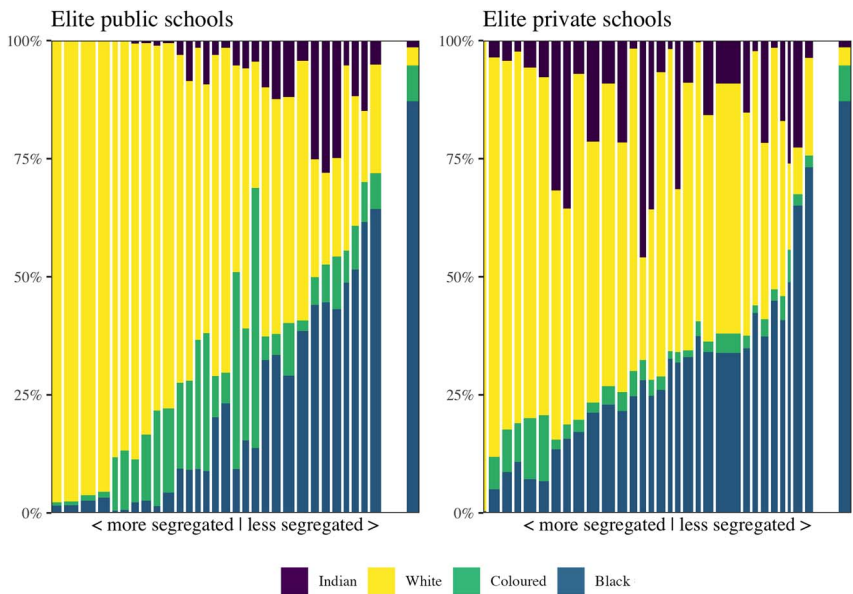


Figure 4. Segregation plot (segplot) for elite public and private schools. Note: Based on the 2021 Annual School Survey. Each vertical line represents one school, ranked by their adjusted local segregation index. The single bar on the right of each graph represents the population distribution. Please refer to [Appendix A](#) for a more detailed description of the segplot methodology.

year. Fees for the 30 elite private schools were much higher, ranging from 132,000 to 200,000 ZAR (~9000–14,000 USD) for day students and up to 300,000 ZAR (21,000 USD) for boarding students.

[Figure 4](#) plots the racial distribution of the most elite public and private schools in South Africa. The aggregate distribution shows that most elite schools in South Africa remain predominantly White. White students (3.8% of the student population) occupy 62% of the spaces in elite public schools and 55% of the spaces in elite private schools. Indian students (1.5% of the population) are also overrepresented in public schools (6%) and elite private schools (13%). Coloured students (7.5% of the population) are overrepresented in elite public schools (12%) but underrepresented in elite private schools (5%). A potential reason for this is the large Coloured population in the Western Cape, where many elite public schools are located. Finally, Black students (87.2% of the population) are vastly underrepresented in both elite public and private schools (20 and 27%, respectively). [Figure 4](#) also shows that the demographic composition of elite schools varies considerably. A few of them—mainly Afrikaans-medium schools—remain almost exclusively White, but others may be described as racially diverse. There are only a handful of elite schools, however, in which Black students form the majority. Interestingly, elite public schools are slightly less racially diverse than elite private schools. This is partly explained by the fact that elite private schools all use English as the medium of instruction, whereas some of the elite public schools are Afrikaans-medium, a language that is spoken mainly by White and Coloured students. English-medium elite public schools are 42% White and 32% Black on aggregate, while Afrikaans-medium elite public schools are 92% White and only 2% Black.

Socioeconomic Segregation and Racial Segregation

Because the Annual School Survey data lack an indicator for family SES, we use the 2019 TIMSS Grade 9 dataset to analyze between-school socioeconomic segregation and its intersection with racial segregation. We compute an aggregate indicator of SES based on both parents' educational levels, the number of books at home, and various household assets. We then use

this variable to calculate the ICC of household SES for each country that participated in the TIMSS (see Appendix D). The ICC is the correlation in SES between two students who attend the same school and can therefore be interpreted as a measure of between-school socioeconomic segregation (Holmlund and Öckert 2021). The lowest segregation levels were observed in the Scandinavian countries, Japan, and Korea ($ICC < 0.10$); the ICC of most other countries was between 0.10 and 0.30. With an ICC of 0.40 ($SE = 0.026$), South Africa had the fifth-highest level of socioeconomic segregation among the 39 countries. From an international perspective, socioeconomic segregation between schools is thus very high in South Africa—rich and poor children are unlikely to attend the same schools.

Because of the strong association between SES and race in South Africa, high levels of between-school socioeconomic segregation are likely to contribute to racial segregation, and vice versa. Despite the emergence of a Black middle class, racial differences in SES remain very large. For example, only 5.7% of Black children belong to the top decile of SES, compared to 59.9% of White children. It is therefore possible that racial segregation emerges as a “by-product” of socioeconomic segregation. In other words, racial segregation might diminish or even disappear once we account for the socioeconomic composition of each school. In statistical terms, this would be equivalent to including SES as a control variable in a regression of school on race. We estimate multinomial regression models that predict school “choice” using race, controlling for SES (see Appendix B for more details). We use bootstrapping to estimate standard errors. This analysis is limited to Gauteng province (which includes Johannesburg) and the Western Cape province (which includes Cape Town), as the sample size of the TIMSS data set is sufficiently large only for these provinces. Gauteng and Western Cape represent roughly 28% of South Africa’s student population.

The baseline multigroup segregation values calculated on the TIMSS data are $H = 0.54$ ($SE = 0.0096$) for Gauteng and 0.55 ($SE = 0.0089$) for Western Cape. Once we include SES as an additive control, the segregation indices are reduced by about 23% in Gauteng and 31% in Western Cape, to 0.42 and 0.38, respectively (see Appendix Table B1 for detailed results). This analysis strongly suggests that the racial segregation we observe is not only due to school sorting by SES: SES explains no more than 23–31% of between-school racial segregation in these two provinces.

In further analysis, we divide students into four groups (White middle class, White working class, middle-class children of color, and working-class children of color) and examine their mutual exposure in schools. “Children of color” here includes Black, Coloured, and Indian students, and “middle-class” is defined as belonging to the top 24% of the distribution of SES, in line with a recent World Bank report (2018). The findings presented in table 5 show that White students’ classmates of color tend to belong to the most socioeconomically advantaged segments. Only 5.8% of the student population encountered by middle-class White students consists of working-class students of color, even though this group constitutes 75.7% of the population. Middle-class White students are more likely to be exposed to middle-class children from other racial groups (28.2%), but most of their classmates are other White middle-class children (61.9%). In contrast, middle-class children of color have comparatively few White children in their classrooms, which are predominantly attended by working-class children of color (54.7%) and other middle-class children of color (40.6%). Table 5 also shows that, compared to their middle-class counterparts, White working-class students attend schools that are much less “White” on average. In combination, these findings reinforce the conclusion that schools are highly segregated along socioeconomic as well as racial lines, with high levels of racial segregation even among children of similar socioeconomic origins, as well as socioeconomic segregation within racial groups.

Discussion

By any measure, school segregation in post-apartheid South Africa remains high. Our findings suggest that the apartheid system of de jure segregation has been replaced by de facto segregation

Table 5. The Intersection between Socioeconomic and Racial Segregation

Population group	Average exposure to:				Population share
	White middle class	White working class	Middle-class children of color ^a	Working-class children of color ^a	
White middle class	61.9	4.0	28.2	5.8	3.2%
White working class	43.1	7.4	21.6	27.8	0.3%
Middle-class children of color ^a	4.4	0.3	40.6	54.7	20.8%
Working-class children of color ^a	0.2	0.1	15.1	84.5	75.7%

Source: Based on the 2019 TIMSS Grade 9 data (weighted). ^a“Children of color” refers to Black, Coloured, and Indian children.

along racial and socioeconomic lines. In contemporary South Africa, the average White child attends a school that is 68.5% White, and the average Black child attends a school that is 96.4% Black. Interestingly, the White isolation index is almost identical to that of the United States (Monarrez, Kisida, and Chingos 2019:6). Since the proportion of White students in the United States is much larger than in South Africa (48 vs 3.8%), this suggests that South African schools are considerably more segregated. South Africa’s levels of between-school socioeconomic segregation are also among the highest in the world. In South African schools, quality and segregation are closely intertwined: the more prestigious the school, the higher the proportion of White students. School segregation and opportunity hoarding therefore sustain the intergenerational reproduction of racial and socioeconomic advantage.

These findings highlight entrenched the racial and class divisions in contemporary South Africa and the enduring influence of patterns of inequality established under apartheid. The fact that former White schools remain highly segregated contradicts the prevailing narratives of integration and “de-racialization” around these schools. It is important to distinguish here between desegregation—where schools’ demographic composition represents the wider population—and racial diversity. Many (but not all) former White schools are racially diverse to varying degrees, but they are not representative of the population. This is particularly true for the country’s most elite schools—the gateway to high-powered careers—where Black children remain markedly underrepresented.

School segregation is intricately linked to apartheid’s legacy of extreme economic, racial, and spatial inequality. South Africa’s bifurcated and semi-privatized school system, where a small number of high-performing, high-fee institutions exist alongside the mass of low-performing or even dysfunctional schools, is another important driver of racial and socioeconomic segregation. Large differences in school quality encourage educational opportunity hoarding, as affluent parents seek to avoid undesirable schools and secure access to the few high-performing institutions. Improving the overall quality of education—especially in former Black schools—remains the main challenge of the South African education system. Extremely high levels of residential segregation also contribute to segregation in schools. Most Black families reside in urban townships and rural areas, far removed from former White, Coloured, and Indian schools. Conversely, elite public and private schools are primarily located in expensive, majority-White neighborhoods in the major metropolitan areas and charge fees unaffordable to most people. We found that residential segregation explains a large share of between-school racial segregation, although substantial levels of segregation remain even at the ward level.

We argue that the political settlement negotiated during the democratic transition facilitated the persistence of de facto segregation when apartheid came to an end. Education policies formulated during negotiations mirrored the broader political settlement, in which the White

minority was permitted to retain most of its socioeconomic privileges in exchange for relinquishing political power. The decision to grant SGBs control over fee levels, admissions policy, hiring, and financial administration created an environment conducive to opportunity hoarding by White parents, now reflected in the vast overrepresentation of White children in the most desirable schools. Several studies have described how SGBs used the array of tools at their disposal—including fee levels, catchment areas, and sibling and heritage policies, as well as language and other admission criteria—to maintain the desired racial and socioeconomic composition of schools (Hunter 2019; Jansen and Kriger 2020; Soudien and Sayed 2003). In practice, this meant that Black children who mixed with White children in former White schools were selected from middle-class families, to ensure that the school's "standards" would not be affected by desegregation. Moreover, qualitative research has shown that integration in former White schools often takes the form of assimilation, with Black children expected to conform to the school's "European" ethos (Carter 2012; Matentjie 2019).

However, over half of the schools that formerly admitted only Whites are now majority—and often exclusively—Black. Jansen and Kriger (2020) show that the likelihood of resegregation depends on factors such as neighborhood composition and proximity to public transport. The most important factor, however, is the SES of the school, which often predates the end of apartheid. Specifically, they found that *precarious middle-class* former White schools are most likely to experience White flight and "turn Black," while stable middle-class and elite schools tend to remain majority White. This is confirmed by our findings on elite public and private schools, most of which remain majority White in a society where White children constitute only 3.8% of the school-age population. Afrikaans-medium instruction represents a major barrier to desegregation in some of the (elite) former White schools.

Our findings raise the question of why successive ANC governments, whose leaders emerged from the struggle against White supremacy and the apartheid system of racial segregation, have allowed structural racism in education to persist. Unlike higher education, where racial quotas have been successfully introduced, school admissions policies remain the exclusive remit of SGBs, although recently proposed legislation seeks to change this (Felix 2023). Governments have hesitated to enforce desegregation over concerns about White children exiting government schools *en masse*, thereby draining the public system of resources. It has also been observed that the current arrangement benefits the growing Black political and economic elite, whose own children can generally access well-resourced schools (Motala and Pampallis 2002). Some middle-class Black parents have vocally opposed desegregation efforts at the school level (Jansen and Kriger 2020). This suggests that opportunity hoarding occurs along both racial and class lines. The interests of middle-class Black and White parents in maintaining privileged access to high-quality schooling for their children are often aligned, making cooperation a natural choice. This echoes Tilly's observation that, in the competition for scarce resources, "often two parties gain complementary, if unequal, benefits from jointly excluding others" (1998: 10). In the South African case, the excluded party is the low-income, Black majority—constituting almost three-quarters of the population—whose children are obliged to attend under-resourced schools where learning outcomes are often dismal (Reddy et al. 2012). Our findings are therefore in line with Seekings and Nattrass' (2005: 6) conclusion that post-apartheid South Africa continues to prioritize the interests of a section of the population although "the composition of the privileged group and the basis of privilege has changed over time." However, this study does not support the reductive notion that "class" has replaced "race" as the main source of social division. SES explains no more than around a quarter of racial segregation, and middle-class children are also segregated by race.

These findings have important implications for social and educational policy in South Africa and beyond. They demonstrate how an economically advantaged minority can monopolize access to the best schools, even in a nominally public system. Educational opportunity hoarding ensures

the intergenerational persistence of race and class privilege and obstructs social mobility. These findings are particularly relevant to other countries where a small, wealthy minority coexists with a large low-income majority, such as India, Brazil, and Nigeria. Elite capture of the few high-performing educational institutions is particularly likely wherever the overall quality of education is low, which is the case in much of the global South.

The South African case might also offer lessons for “super-diverse” American and European cities where White children increasingly constitute an economically privileged minority. One such lesson might be that moral discourses about individual responsibility and the benefits of diversity may not suffice to prevent extreme segregation. In South Africa and elsewhere, segregation results from parents’ natural tendency to seek the best possible school for their children. The problem is that only some groups of parents have the economic, cultural, social, and symbolic resources to translate this tendency into concrete educational advantages (Lewis and Diamond 2015). The presence of segregation therefore does not necessarily imply pernicious motives: data from the South African Social Attitudes Survey show that a large majority of South Africans from all backgrounds are in favor of racially and socially integrated schools. Only decisive government action—in the form of mandatory desegregation policies—can overcome the powerful tendency of privileged groups to maintain privileged access. As long as schools differ greatly in their resources and achievement, however, there will be powerful incentives for opportunity hoarding. Segregation is therefore unlikely to reduce unless efforts are made to reduce racial wealth gaps and improve educational performance across the board.

Although our findings paint a comprehensive picture of social and racial segregation in South African schools, a number of limitations remain. Most importantly, we could not examine historical trends in school segregation, so it remains unclear whether segregation is stable, increasing, or decreasing. We were also unable to look at within-school segregation, which is likely to be substantial, especially in dual-medium schools. Future researchers could also conduct more in-depth spatial comparisons, looking at the local and regional factors that influence school segregation. Finally, it would be fruitful to conduct more in-depth qualitative research on school admissions and diversity policies.

Endnotes

1. The apartheid-era racial classification remains common in South Africa and is used by Statistics South Africa and the DBE to describe population groups. “White” denotes the Afrikaans-speaking descendants of Dutch settlers, as well as the predominantly English-speaking descendants of more recent European immigrants. “Asian/Indian” refers to the descendants of indentured laborers and immigrants from British India, most of whom are now native English speakers. “Coloured” refers to a multi-ethnic population group who are descended largely from Cape Malays, the indigenous Khoi/San population, and other people of African, Asian, and European origin (see Adhikari 2005 for a history of “Coloured” identities in South Africa). Most Coloured people speak either English or Afrikaans as a first language. Finally, “Black Africans” refers to native South Africans such as the Xhosa and Zulu people, most of whom speak English as a second language.
2. Data on 2021 school fees were derived from <https://www.businessinsider.co.za/south-africas-most-expensive-state-schools-cost-around-50k-per-year-2021-2> and <https://businessstech.co.za/news/trending/459994/the-most-expensive-schools-in-south-africa-in-2021/>.
3. Analysis by authors, based on the 50 largest core-based statistical areas in the 2018 Common Core of Data.
4. Our analysis covers public schools only, and excludes schools established after the democratic transition.

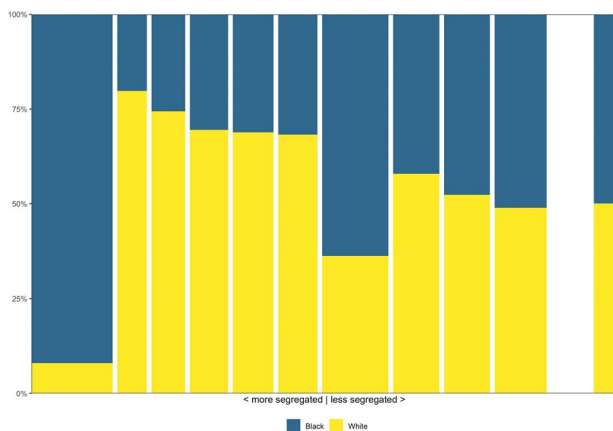


Figure A1. A simple segplot with ten schools and two racial groups.

Appendix A

Segplot: A new tool for visualizing patterns of segregation

In this study, we introduce a new way of visualizing patterns of segregation between units such as schools, workplaces, or occupations. Indices of segregation, like the Mutual Information Criterion M or Theil's Information Index H provide a mathematical representation of segregation (e.g. the association between two categorical variables). However, they are highly technical and do not have an intuitive interpretation.

Figure A1 shows an example “segplot” with simulated data for ten schools and two racial groups. Each bar in this plot represents an individual school. The width of the bar indicates the relative size of the school, e.g., we can see that the first school on the left is the largest school. The key information shown for each school is the within-school racial distribution. For instance, the first school on the left is attended by roughly 90% Black and 10% White students.

The bar that is offset furthest on the right shows the “reference distribution,” which in this case is the racial distribution of the pooled data. For instance, if these ten schools were all located in one city, the reference distribution would then be the overall racial distribution in this city. This can also be interpreted as the distribution of a perfectly integrated unit, e.g., one that does not contribute to segregation at all. If there was no segregation at all, we would expect that each school replicates this overall racial distribution. For the example in figure A1, this is a 50–50% split between Black and White students. The ordering of the schools reflects this logic: schools further to the right resemble the reference distribution more closely, and the distance increases when moving to the left side of the graph. Hence, schools furthest to the left are the most segregated schools, based on the local segregation measure L_s . Overall, the segregation pattern in figure A1 translates into an H index of about 0.17.

A visualization such as this can also be helpful in understanding the *pattern* of segregation. Take the example in figure A2, which shows two different segplots. (We removed the spacing between the schools in these plots, and ordered the schools not by their local segregation, but by racial composition to show the differences more clearly.) Both of the two underlying datasets have identical overall population distributions (50–50%), and both have an H index of about 0.27. Despite that, the segregation patterns look quite different: In the first plot, there are some schools that are quite integrated, while in the second example all ten schools have a strong majority–minority pattern.

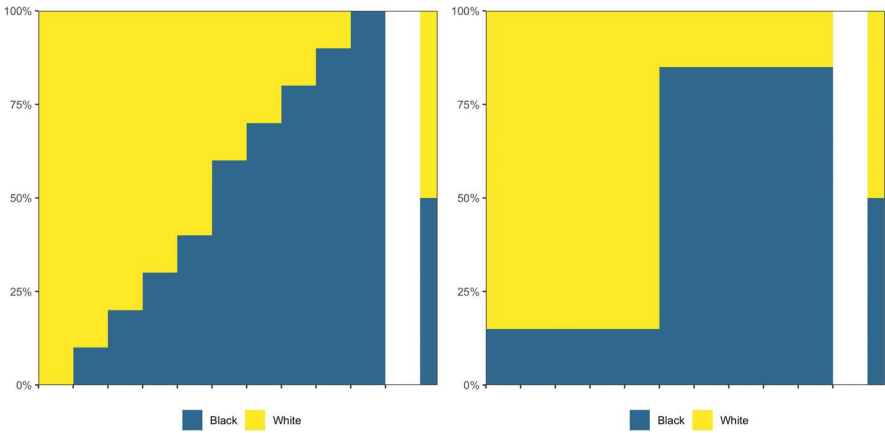


Figure A2. Two segplots with the same H (0.27), but different patterns of segregation

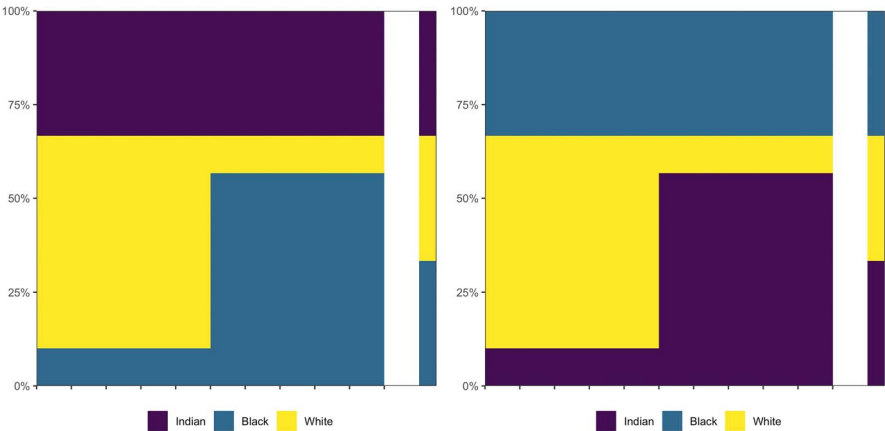


Figure A3. Two segplots with the same H (0.16), but different patterns of segregation

Figure A3 shows a second example, which illustrates that similar H values in multigroup settings can obscure very different patterns of segregation. In the first plot, the Asian population is, in fact, perfectly integrated, while the Black and White populations are segregated. In the second plot, which has the same H value, the Black population is perfectly integrated, while the Asian and White populations are segregated. A segplot can help with elucidating these different patterns.

One downside of segplots is that they can become visually noisy once a large number of units are considered. An example is shown on the left-hand side of figure A4, which shows an artificial dataset with around 2000 schools. One possibility, in this case, is to “compress” the original dataset to retain its overall H value as well as the segregation pattern. A possible algorithm to do so is the following:

- (1) For each possible pair of school, consider the pair that, when it would be combined, would produce the smallest change in segregation.
- (2) Merge the two schools into one “combined” school, and repeat.

Note that if two schools are merged, segregation can only decrease. Hence, when eventually all schools are combined into one “super school,” segregation is minimized at zero. Empirically, it

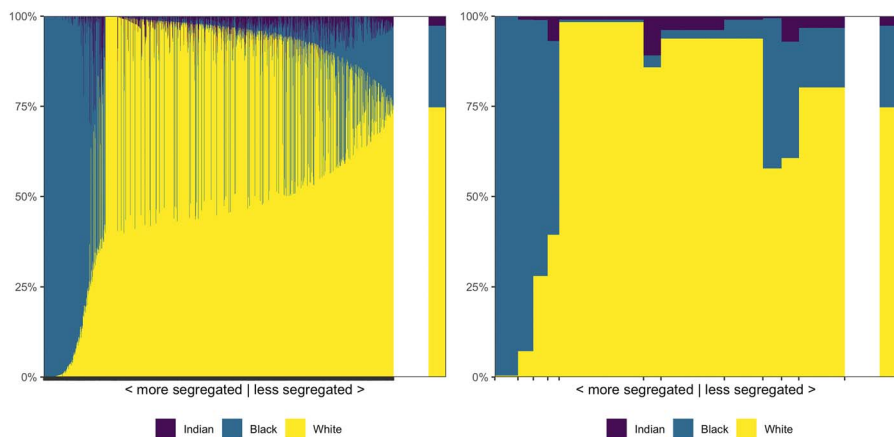


Figure A4. An uncompressed ($H = 0.48$) and a compressed segplot ($H = 0.46$)

turns out that many datasets can be compressed enormously without much loss of information. Applying the algorithm to the dataset on the left-hand side of A4 shows that we could merge the 2000 schools into an artificial set of 49 schools, resulting only in a 1% reduction in the H value (i.e., the reduced dataset retains 99% of the original segregation information). With eleven schools, we would still retain 95% of the information—in numbers, this represents a reduction of the H from 0.479 (original dataset) to 0.456 (compressed dataset). The right-hand side of figure A4 shows the combined eleven schools. The segplot on the right-hand side can therefore be regarded as a faithful simplification of the more complex situation on the left-hand side, while losing only 5% of information.

Appendix B Accounting for covariates in multi-group segregation

Seiler and Jann (2019) present a framework for computing adjusted segregation indices that control for discrete and/or continuous variables. This framework is based on the Mutual Information Index (M) of segregation, which is closely related to the H index that we use in the main paper. The two indices are related by the equation

$$H = \frac{M}{E(p_g)}$$

i.e., the M index simply lacks the division by the racial group entropy.

The key step in allowing individual-level covariates in the segregation estimation is to rewrite the segregation index at the level of the individual. Let $i \dots N$ index individuals, where S_i is the school that individual i attends, and R_i is the racial group of individual i . Then define the quantity

$$m_i = \log \left(\frac{\Pr(S = S_i | R_i)}{\Pr(S = S_i)} \right),$$

where $\Pr(S = S_i)$ is the a-priori probability that individual i attends the school that they attend (in practice this is just the population proportion of that school), and $\Pr(S = S_i | R_i)$ is the conditional probability that individual i attends the school that they attend when we condition on

Table B1. Details Results for Gauteng and Western Cape

	H index			% reduction obtained by conditioning
	Standard estimator	Multinomial approach	Conditional on SES	
Gauteng	0.533 (0.0095)	0.536 (0.0096)	0.416 (0.0096)	22.5% (1.25)
Western Cape	0.548 (0.0088)	0.553 (0.0089)	0.383 (0.0085)	30.7% (1.03)

Note: Debiased estimates based on 100 bootstrap replications. Standard errors in parentheses.

individual i 's racial group. If we average m_i over the population of individuals, we obtain the M index:

$$M = \frac{1}{N} \sum_{i=1}^N m_i.$$

Assume now that we have a set of individual-level control variables, X_i , that we want to include in the index calculation. Seiler and Jann (2019) show that we want to modify m_i by conditioning on X_i :

$$m_i^* = \log \left(\frac{\Pr(S = S_i | R_i, X_i)}{\Pr(S = S_i | X_i)} \right).$$

An adjusted M index can then again be obtained by taking the mean over the individual values:

$$M^* = \frac{1}{N} \sum_{i=1}^N m_i^*.$$

Usually, the quantities $\Pr(S = S_i)$ and $\Pr(S = S_i | R_i)$ are estimated through maximum likelihood estimation based directly on the relevant contingency tables. This still works for $\Pr(S = S_i | R_i, X_i)$ and $\Pr(S = S_i | X_i)$, but only if all control variables in X_i are discrete. If there are continuous control variables—as in our case—, we have to estimate these probabilities in some other way.

We follow Seiler and Jann (2019) and estimate these probabilities through multinomial logistic regression. Estimating m_i^* requires two models: One “unrestricted” model to estimate $\Pr(S = S_i | X_i)$, and one “restricted” model to estimate $\Pr(S = S_i | R_i, X_i)$. The first model is a multinomial regression model predicting school choice, adjusting for X_i ; the second model is a multinomial regression model predicting school choice, adjusting for X_i and R_i . The predicted probabilities from these models can then be used to compute m_i^* and M^* . In practice, we estimate these models using the `multinom` function of the R package “nnet.” For more details on this approach, see Venables and Ripley (2002). All models converge according to the convergence checks that `multinom` employs. We check whether these models produce sensible results by comparing the H indices that are obtained from the multinomial logistic regression approach with the standard estimation of segregation indices (using the MLE estimators that are defined in the Methods section). The difference is less than 1%—some of which is also due to simulation uncertainty—which means that this estimation approach yields results that are very much in line with standard estimators. Additionally, we bootstrap results using 100 replications.

Appendix C

Segregation plots for all major metropolitan areas

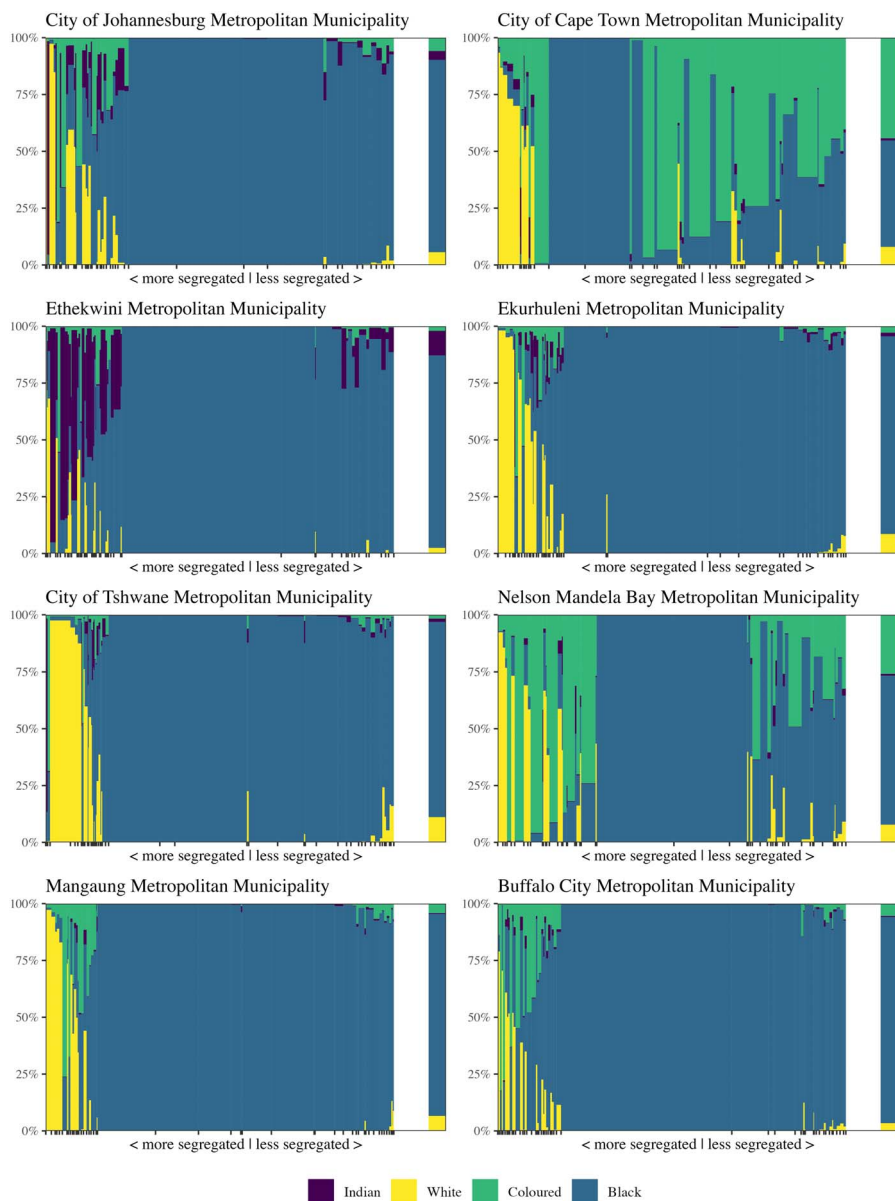


Figure C1. Segregation plots (segplots) for South Africa's eight major metropolitan areas. Note: Based on the 2021 Annual School Survey. Compression has been applied as described in Appendix A. The vertical lines represent schools or groups of schools, ranked by their adjusted local segregation scores. The single bar on the right represents the population distribution of the respective metropolitan area.

Appendix D

Socioeconomic segregation in internationally comparative perspective

Between-school socioeconomic segregation is measured by the ICC of household SES. The ICC is based on a random effect model predicting the SES of each individual i in school s :

$$SES_{is} = \alpha_s + \varepsilon_{is}$$

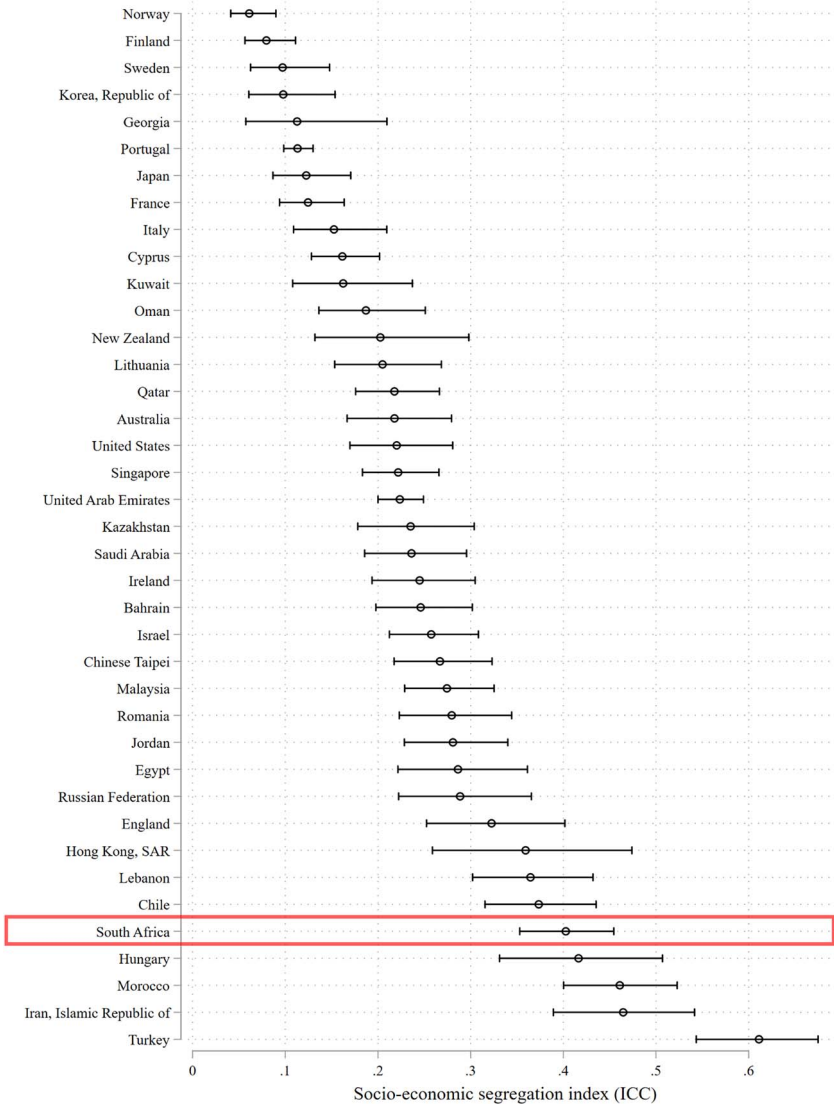


Figure D1. Between-school socioeconomic segregation, by country. Note: Based on the TIMSS 2019 Grade 8/9 data using school and student weights (scaled to the effective cluster size). Capped bars show 95% confidence intervals. Socioeconomic segregation is defined as the intra-school correlation of household SES.

where α_s is the random school intercept and ε_{is} is the residual. The intraclass correlation is then calculated as the ratio of between-school variation to total variation:

$$ICC = \frac{\sigma_\alpha}{\sigma_\alpha + \sigma_\varepsilon}$$

where σ_α is the between-school variation in SES and σ_ε is the within-school variation. Similar to the multigroup segregation index H, the ICC is equal to 0 (no segregation) when each school's socioeconomic composition is identical to that of the overall population, and it is equal to 1 (perfect segregation) when all students in each school have the same socioeconomic background. Figure D1 presents the ICC of SES for each country that participated in 2019 TIMSS survey (grade 8/9).

Appendix E

Segregation attitudes in South Africa

Table E1. Responses to School Segregation Questions in the 2018 South African Social Attitudes Survey (Weighted)

	Black N = 1798	Coloured N = 415	Indian N = 360	White N = 312	Total N = 2885
To what extent do you agree or disagree with the following statements?					
"All schools should contain children of different races"					
Strongly agree (%)	36.4	45.6	44.8	22.5	36.2
Agree (%)	52.5	41.6	36.7	41.8	50.0
Neither agree nor disagree (%)	6.1	7.0	8.6	24.4	8.0
Disagree (%)	3.4	2.8	6.1	7.8	3.8
Strongly disagree (%)	1.2	3.0	3.9	3.4	1.7
Do not know (%)	0.4	0.1	0.1	0.1	0.4
"The children of the economically well-off and the poor should be educated together"					
Strongly agree (%)	22.4	21.4	22.4	14.0	21.5
Agree (%)	54.7	43.9	42.0	38.8	51.9
Neither agree nor disagree (%)	8.9	17.3	13.6	31.1	11.9
Disagree (%)	10.0	13.0	8.2	13.3	10.5
Strongly disagree (%)	3.2	3.0	13.8	1.8	3.3
Do not know (%)	0.8	1.4	0.0	0.9	0.8

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Data Availability Statement

The Annual School Survey data are not publicly available but can be requested from the Department for Basic Education (DBE). The restricted TIMSS data, which includes the student race variable, is not publicly available but can be requested from TIMSS South Africa.

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