

Testing for Black-White Convergence in South African Education after Apartheid

In 1994, South Africa had its first democratic elections, putting a formal end to Apartheid, one of the most discriminatory regimes in the world. Using a difference-in-differences strategy, this paper investigates whether there was a convergence in education outcomes among black students relative to white students after the fall of Apartheid. Cross-section data from the GHS-2013 suggest no gain in the completed years of education and matriculation completion for both black African men and women relative to whites, after Apartheid. Robustness checks indicate partial convergence in the years of education and matriculation differential between black and white individuals during the Apartheid years from 1948-1994.

Was the fall of Apartheid in South Africa important in improving the socio-economic outcomes of black individuals? South Africa in the Apartheid era was characterized by extreme domination of whites over blacks. With respect to education, racial segregation meant fewer resources and separate schools for blacks with funding conditional on the acceptance of a racially discriminatory curriculum.

The first democratic elections in South Africa took place on the 27th April 1994 and marked the end of Apartheid. With regards to education, the newly-elected South African government enacted the South African Schools Act of 1996 (SASA) with the objective of putting an end to fragmentation along racial lines and unequal access to education by ethnicity (Fiske and Ladd, 2004).

In this paper, I try to evaluate the effect of the fall of Apartheid on the education outcomes of blacks relative to whites. My main innovation is to exploit the plausibly exogenous variation in access to education resources for black individuals after the fall of Apartheid. In 1994, the new democratic government put an end to discrimination on the basis of race. This resulted in substantial increases in education resources for black Africans. Whereas for whites, they were less affected by the 1994 reforms, as they continued to have access to these education resources even after Apartheid. This heterogeneity enables me to use a difference-in-differences (DID) strategy, to compare the education outcomes of blacks relative to whites before and after 1994, after controlling for cohort and race fixed effects. To the best of my knowledge, there are no studies that look at the convergence in education outcomes for blacks relative to whites in South Africa after the demise of Apartheid.

My results do not provide positive evidence of convergence in education outcomes between blacks and whites after the demise of Apartheid. There is a positive but insignificant gain of 0.16 years in completed years of education among black African individuals after Apartheid, relative to whites. By gender the point estimates show a positive gain of 0.18 years in completed years of education for black African boys receiving education after Apartheid relative to white boys, though again the coefficients are not statistically different from zero. Likewise, for black African girls, the estimated effects are positive and have similar magnitude, but the coefficients are not statistically different from zero. The findings are similar when the education outcomes are measured by rate of matriculation completion. Black African boys have about a six percent higher chance of completing matriculation or higher after Apartheid, relative to white boys, however the estimates are again not statistically different from zero. For black African girls, the point estimates have an

unexpected sign, indicating a fall in the probability of matriculation completion after Apartheid, though the estimates are again not statistically different from zero.

I conduct a number of checks to assess the robustness of my findings to potential confounders. First, I include race-specific linear and quadratic time trends in the difference-in-differences specification to allow for any pre-existing trends in education outcomes between blacks and whites during the pre-reform period, which could result in the estimates to have an upward or a downward bias. Second, placebo tests on the year of reform indicate partial convergence in education outcomes for blacks relative to whites during the latter part of the Apartheid years.

Two important developments in South Africa after 1990 may explain why I do not find positive effects on education outcomes for blacks after the fall of Apartheid. First, there was an outbreak of HIV in South Africa during the 1990's. The spread of the HIV/AIDS epidemic may have eroded the participation gains resulting from the post-Apartheid education reforms as more and more died or dropped out of school, either because of personal HIV/AIDS illness or HIV/AIDS illness in the family (Jansen and Taylor, 2003). The spread of HIV may also have lowered the perception of future returns to educational attainment among black children. Second, during the late 1990's the Department of Education (DoE) of the Republic of South Africa implemented two policies to improve the internal efficiency of the education system. First, to restrict the number of over-age and under-age learners in schools. Second, to restrict the number of times a learner could repeat grades. The impact of these policies was a dramatic fall in the growth of primary and secondary school enrolments from 1997 to 2000. Blacks were more likely to be affected by these policies than whites due to high dropout rates in the former black schools during the Apartheid era (Burger et al., 2012).

I exploit the demise of Apartheid in South Africa to evaluate the role of desegregation, schooling resources and migration on the education outcomes among blacks. This event in South African history could have had an impact on the education outcomes of blacks for numerous reasons.¹

First, with the demise of Apartheid there was an end to segregated schools in South Africa. An extensive literature in the US finds that desegregation in schooling led to better education outcomes, improved test scores among black students from desegregated schools (Crain and Mahard 1978, cited in Crain and Strauss, 1983) and higher years of education and higher wages for black students from schools with a lower fraction of black students (Boozer et al., 1992). Using a difference-in-differences framework, Guryan (2004) finds a 2-3 percentage point fall in the dropout rate of blacks in school districts that desegregated during the 1970's compared to the change in the black dropout rate in districts that did not desegregate during this period. More recently, Ashenfelter et al. (2006) find positive effects of school desegregation on high school completion rate and income among blacks. The literature identifies three main channels through which desegregation affects outcomes: (i) exposure to white peers, which could lead to better outcomes for blacks later in life due to socialization or assimilation; (ii) desegregation could improve the outcomes of black children by changing their perception towards education and the future returns of educational attainment and (iii) desegregation enabled effective equalization of schooling resources (Ashenfelter et al., 2006).

¹ During Apartheid, people were categorized into four official population groups: Whites, Asians, Coloureds and Africans. Blacks in the study refer to black Africans.

In some other studies of the US, black graduates of desegregated schools were also more likely to find themselves in desegregated employment working with white co-workers (Braddock et al., 1984). Using a randomized experiment design, Crain and Strauss (1985) report that students were more likely to work in white-collar and professional jobs if they attended a desegregated school, than those who went to segregated schools. Likewise, Grogger (1996) finds a negative relationship between black wages and the percentage of schoolmates who were black.

In the case of South Africa, with the end of Apartheid, the newly-elected democratic government also made efforts to improve schooling inputs in the former black schools (Fiske and Ladd, 2004 and South African Schools Act (SASA), 1996). Case and Deaton (1999) exploit the exogenous variation in the pupil-teacher ratio among black schools during Apartheid in South Africa, to study the impact of educational inputs on schooling outcomes. They find positive and significant effects of school inputs (the pupil-teacher ratio) on school attendance, educational achievement and test scores, after controlling for household background variables among black children. In addition, Card and Krueger (1992) focus on schooling quality in closing the earnings gap among blacks relative to whites in the US. The study reports a 15 to 20 percent narrowing of the earning gap between blacks and whites between 1960 and 1980, attributable to improvements in the relative quality of black schools in the southern states of the US.

Third, under Apartheid, black residents were confined to homelands or “Bantustans” and faced severe restrictions on movement.² With the end of Apartheid, these homelands were

² During the Apartheid government, there were four independent homelands: Transkei, Bophuthatswana, Venda and Ciskei. There were six other homelands which remained part of the RSA but held self-governing rights. These were Gazankulu, KaNgwane, KwaNdebele, KwaZulu, Lebowa, QwaQwa. Black people were forcibly

reintegrated and the existing four provinces were divided into nine provinces, allowing black households to migrate to areas with better schools.

Two recent papers by Tanaka (2014) and Tanaka and Ito (2014) study the effect of abolishing user fees for health services on the health and education outcomes of black children, exploiting exogenous variation in access to health services in South Africa after Apartheid.³ Using the KwaZulu-Natal Income Dynamics study, a panel dataset for the KwaZulu-Natal province in South Africa, the study examines the effect of free health services on the health status of the new born, aged zero to three, before and after the health reforms in 1994. The study finds a positive evidence of free health services on average weight-for-age z-scores for newborns. The study also finds a positive impact of improved health status on educational investments and on lowering fertility. Since the new reproductive health policy abolished user fees for health services for children under six years old in 1994, it is unlikely that treated cohorts in my study have had improved access to health care as I compare cohorts who were

assigned to one of these homelands. On 27th April 1994, the homelands, also referred as Bantustans, were reintegrated and the existing four provinces were divided into now nine provinces of South Africa. These 9 provinces are: Northern Cape, Western Cape, Eastern Cape (Transkei and Ciskei became part of Eastern Cape), Free State (Qwa Qwa has been part of the free state province since 1994), North West, Gauteng, Kwazulu-Natal (KwaZulu was integrated into the former province of Natal to form this province), Mpumalanga (KaNgwane and KwaNdebele became part of Mpumalanga in 1994) and Limpopo (name of Northern Province changes to Limpopo in 2003) (Venda, Lebowa and Gazankulu became part of Limpopo province). Bophuthatswana was reintegrated into the provinces of Free State, Northern Cape and North West province. Cape of Good Hope province was divided into Northern Cape, Western Cape and Eastern Cape after 1994. Transvaal divided into the new provinces of Northern (now Limpopo), Gauteng, Mpumalanga and also North West.

³ With the end of Apartheid, newly-elected South African government abolished user fees for health services for children under six years of age and for pregnant women at public facilities since June 1994 (Republic of South Africa, 1994 and Tanaka, 2014).

aged five to eighteen in 1994 (post-reform observations) with those aged nineteen to twenty-nine in 1994 (pre-reform observations).⁴

The rest of the paper is organized as follows. Section 1 provides the background and an overview of the education outputs in South Africa by race. Section 2 discusses the data and summary statistics. The empirical strategy and results are covered in Section 3. Section 4 presents validity and robustness checks. Section 5 concludes.

⁴ Since the post-reform observations in this study includes individuals aged five in 1994 who could have had access to improved health services, I repeat my analysis excluding these from my sample as a robustness check.

1. Background

White settlers in the 17th Century imposed racial inequality in South Africa. It was institutionalized, codified and reinforced in 1948 when the Afrikaner National Party won the general election in that year. The Afrikaner National Party began enforcing policies of racial segregation under a system of legislation it called “Apartheid”. One of the most devastating elements of Apartheid, the Bantu Authorities Act of 1951, enforced residential segregation. Blacks were forcibly removed from their homes and deposited into poor and infertile areas called “homelands”, also referred to as “Bantustans”. These homelands were economically marginalized, overcrowded and impoverished areas. With respect to education, the Bantu Education act of 1953 centralized control of black education with public expenditure on black education linked to the tax receipts from blacks (Thomas, 1996). In 1975, the Apartheid government expenditure on an average white student was 15 times more than on an average black student (Thomas, 1996). Fiske and Ladd (2004) point to four aspects of the Apartheid legacy for education: “residential segregation and persistent poverty among black Africans, inadequate resources and low-quality instruction for black children, a low level of educational attainment among black adults and low student achievement, and the absence of an adequate culture of learning” (Fiske and Ladd, 2004, page 52).

The Soweto uprising in 1976 changed the political landscape of South Africa. Increasing resistance from black people, coupled with pressure from the international community, intensified negotiations to put an end to Apartheid. From 1990 onwards, the discrimination laws under Apartheid started to be abolished, with the first democratic elections in South Africa on 27th April 1994 putting an official end to Apartheid. With respect to education, a single national department of education was created from the existing nineteen racially, ethnically and regionally divided departments of education. The new South African

government led by President Nelson Mandela enacted the South African Schools Act of 1996 (SASA) with the objective to desegregate schooling, to use fiscal measures to achieve the goal of equity in education, and to promote anti-discrimination policies throughout the education system. For the first time in South African history, individuals could apply to any school without facing any discrimination by race.⁵ Nine years of compulsory education was introduced for all learners regardless of their race from age seven till age fifteen under the SASA act (Fiske and Ladd, 2004 and South African Schools Act, 1996).

In order to equalize education resources the Department of Education (DoE) began the process of rationalization and redeployment of teachers with an agreement of a pupil-teacher ratio of 40:1 for primary schools and 35:1 for secondary schools, to be implemented over the period 1996-2000. Teacher salaries were also adjusted as of July 1, 1996, with the intention to treat all teachers the same. In addition, salaries of teachers of black students were revised upwards in line with the former-white education departments. The new government also made efforts to improve basic infrastructure in schools. With regards to school quality, in 1995, the Department of Education (DoE) began the process of equalizing budget allocations to provinces. Spending on education was above average for the poor provinces of KwaZulu-Natal, Eastern Cape and Limpopo over the period 1995-1996 to 1997-1998 (Human Resources Development Review, 2003).

⁵ The South African Schools Act (SASA) of 1996 gave school governing bodies the authority to determine which students to admit, provided they admit pupils and fulfil their educational requirements without unfairly discriminating in any way (Fiske and Ladd, 2004).

1.1 Education Outputs in South Africa

Before investigating the possible convergence in education outcomes of blacks and whites after the end of Apartheid, I describe separately the educational attainment among blacks and whites over time. Fig. 3.1-3.2 show educational attainment by age for blacks and whites, as measured by the years of schooling completed. The data come from the General Household Survey-GHS 2013, in response to a question about the highest education level attained, which I have converted to years of education at the rate of one year per grade. Fig. 3.1 shows educational attainment by age for blacks and whites for people aged zero to twenty-three in 2013. Both black Africans and whites have the same years of education till about age fifteen after which whites perform better than blacks at all ages. The increasing dispersion in educational attainment between black Africans and whites is evident from age fifteen, during the secondary stage of schooling.⁶ The reason why black Africans lag behind whites in educational attainment after a certain age could be either because of grade repetition or drop outs. From Fig. 3.2, whites born from 1968 to 1989, aged between twenty-four and forty-five in 2013, on average have just under thirteen years of education irrespective of their year of birth. On the contrary, there is a clear positive trend in education attainment for blacks, such that those born in 1989 have completed one and half more years of more schooling than those born in 1969. However educational attainment for black Africans remains lower than whites for all birth cohorts.

Fig. 3.3 shows the percentage of individuals with matriculation or higher for blacks and whites born from 1968 to 1989. Again, the findings are similar with roughly four-fifths of whites receiving on average matriculation or more, irrespective of their year of birth. On the

⁶ Individuals in South Africa attend secondary school between the ages of fourteen and eighteen.

other hand, only two-fifths of blacks have attained matriculation or higher, although again there is a positive trend in the matriculation rate among blacks over time. Fig. 3.1-3.3 shed light on two important facts. First, there is was a partial convergence in the completed years of education between black and whites over time. The average years of education differential between black and whites fell from 3.78 years in 1968 to 1.97 years in 1989. This convergence over time was due to increasing education among blacks. Second, the dispersion in the years of education between blacks and whites starts at the age of 13, when children finish primary school to go to secondary school. Fig. 3.4, I show the increase in educational attainment over time among blacks by gender. There is an increase in the years of education over time for both black males and females. However black females have overtaken their male counterparts over time. Black males born in 1953 and observed in 2013 have on average 0.7 more years of education than black females. But black females born after 1981 have completed more years of education than black males with an average female advantage of 0.45 years for those born in 1989. Similarly, for the matriculation rate, black females have overtaken their male counterparts over time, see Fig. 3.5.⁷

Since the study involves comparing education outcomes of black and white children who received education before and after the demise of Apartheid, I look at the enrolment rate among blacks and whites across various ages between two cross-section GHS surveys, 1994 and 2013. The GHS questionnaire asks the head of the household, whether each person in the household, aged five or over, is currently enrolled in education or not. Table 3.1 reports the

⁷ Fig. A.1 and A.2 in the Appendix also shows the completed years of education and percentage of individuals with matriculation completion by age for black africans aged between 4 and 29 in 1994, for both males and females.

enrolment rate by race and age starting from age five.⁸ Table 3.1 shows that there is an increase in enrolment rate among blacks, between ages five and seven, between the two surveys. Eighty-eight percent of blacks were enrolled in schools at age seven in 1994, the official age at which children start school in South Africa. Black children start school later than whites who were about ninety-five percent enrolled by age seven, for people observed in the 1994 survey.

However, based on the 2013 survey, ninety-nine percent of blacks were in school by age seven. Comparing the enrolment figures in the 1994 survey with the ones from the 2013 survey shows that blacks have been catching up against whites. Unlike the drop in enrolment among blacks at the age of sixteen for people observed in the 1994 survey, fewer blacks are dropping out of school at age sixteen in the 2013 survey (Column (5) of Table 3.1). Furthermore, enrolment rates among blacks and whites are similar at the age of eighteen for people observed in the 2013 survey (cf. Columns (5 and 7) of Table 3.1). The rise in enrolment rate among blacks is accompanied by a rise in the percentage of blacks with matriculation. About forty-three percent of blacks between the age of twenty-one and twenty-three have attained matriculation, which is significantly higher compared to the percentage of blacks between the age of twenty-one and twenty-three who attained matriculation in the 1994 survey (cf. Columns (2 and 6) of Table 3.1). This indicates that more blacks were staying in school longer to complete high school. In contrast to the high enrolment among black students at later ages in comparison to white students in the 1994 survey, fewer black

⁸ I report the enrolment rate by race and age from two GHS surveys: 1994 and 2013. As GHS replaced the October Household Survey in 1999, the 1994 figures are from the October Household Survey conducted in the year 1994.

students were enrolled in schools after the age of twenty in the 2013 survey (cf. Columns (5 and 7) of Table 3.1).

Since the General Household Surveys in South Africa do not collect data on numeracy or literacy test scores for children, this study uses the matriculation rate, twelve or higher years of education, as a measure of education attainment in South Africa. Also since enrolment at both primary and secondary schools was rising in South Africa from 1975, the study uses completed years of education and matriculation rate as measures of education outcomes. The rise in enrolment among blacks was partly due to the increasing demand for education by black people and partly due to the rapid expansion of the African education by the Bantustan authorities (Human Resources Development Review, 2003 and Van Der Berg, 2007).

2. Data Source and Descriptive Statistics

To study the impact of the end of discrimination by race on education outcomes of blacks, I use the General Household Survey (GHS) 2013, a cross-sectional household survey covering all the nine provinces of South Africa. The GHS are annual household surveys conducted by Statistics South Africa (Stats SA) since 2002.⁹ GHS 2013 was conducted between October and December 2013. The GHS surveys collect data on education outcomes such as: highest education level, literacy, health and social development, household access to services and facilities, food security and agriculture.

For the purpose of this study, I restrict my sample to only black Africans and whites. Black Africans constitute the majority of the South African population.¹⁰ Also, black africans were the worst affected during Apartheid. This combined with the fact that the new democratic government aimed at protecting and redistributing resources towards the most disadvantaged groups, black Africans are most likely to have benefitted from the end of the discrimination laws in 1994. My sample includes individuals who were aged twenty-four or more at the time of the survey and hence are likely to have completed their education.

Individuals who were aged seven or under in 1994 are likely to have started education after the end of Apartheid. South African children attend primary and secondary school between

⁹ The survey replaced the October Household Survey (OHS) which was introduced in 1993 and terminated in 1999.

¹⁰ As per the South Africa Population Census 2011, 10 percent Meta data, blacks contribute the largest population in South Africa, at 79.2 percent, with the population of whites at 8.9 percent.

the ages of seven and eighteen.¹¹ The first seven years comprise of primary schooling and the later five years as secondary schooling. Thus any individual born in 1965 or before would be aged nineteen or more in 1994, and may not have benefitted from the reforms as it is likely that the individual would have left school before the school year of 1994-1995, when the policy change took place. I therefore define individuals born between 1976 and 1989, aged five to eighteen in 1994, as the treatment cohorts (post-Apartheid cohorts) and individuals born between 1965 and 1975, aged between nineteen and twenty-nine in 1994, as the comparison group.¹² Thus, my sample consists of 7972 blacks and 1173 whites, aged between 19-29 in 1994 and 15492 blacks and 1114 whites, aged between 5-18 in 1994.

Indeed, grade repetition or early and delayed school entry could have led some individuals older than eighteen to benefit from the reforms, resulting in the estimated effect to have a downward bias. Similarly, children dropping out of school long before 1994 are unlikely to have benefitted from the reforms even if they were less than eighteen in 1994 and this could result in the estimated effect to have an upward bias. However, since I am including all the non-compliers as treated, I am effectively estimating the intention-to-treat effect (ITT).

In summary, Table 3.2 presents the baseline summary statistics on the individual education outcomes and a variety of household characteristics for those who received education before and after 1994, defined over blacks and whites using the sample in GHS 2013. I define the treatment status based on the race and year of birth of an individual. Blacks faced

¹¹ The General Household Survey, 2011 does not ask the respondents their date of birth. I impute the year of birth of individuals from respondent's age in the data.

¹² As a measure of robustness: (1) I exclude individuals aged fifteen to twenty in 1994 from the analysis as their treatment status is unknown, as they may or may not have been affected by the fall of Apartheid. (2) I exclude individuals aged five in 1994 from the analysis as they could have been affected by the free health service policy introduced by the new South African government in 1994.

discrimination in resources during Apartheid while whites did not. After the policy change in 1994, blacks gained access to improved education resources. In contrast, whites had access to these resources during Apartheid and had access to these resources even after the end of Apartheid in 1994. Column (1) presents figures for blacks whereas column (2) focusses on whites, for the cohorts receiving education before 1994. Column (3) shows the difference in means between the two races for the respective variables. Likewise, columns (4-6) focus on the means for blacks, whites and the differences in means, respectively, for cohorts receiving education after 1994.

As expected, both the individual and household characteristics for people observed in GHS 2013 differ significantly between blacks and whites for cohorts receiving education before 1994. The differences in the average education outcomes (percentage of individuals with matriculation or higher, completed years of education and percentage with at least compulsory years of education) between blacks and whites for pre-reforms cohorts are statistically significant.¹³ For example, blacks aged 19-29 in 1994 had on average 9.32 years of completed education. Whereas, for whites aged 19-29 in 1994, they had 12.68 completed years of education. Similarly, only 34 percent of blacks hold matriculation, while 85 percent of whites hold matriculation, for the same cohorts. This is consistent with the fact that blacks were severely limited in the quality of education inputs during Apartheid. Similarly, with respect to the household characteristics, the monthly household income for whites is significantly higher than for blacks for pre-reform cohorts (cf. Columns (1-2), Panel (A)).

¹³ For the purpose of the study, I impute percentage of individuals with matriculation or higher and percentage of individuals with at least compulsory education from the completed years of education variable. Children in South Africa achieve matriculation when they complete twelve years of education. Since 1994, the Department of Education, South Africa has made the first nine years of education as compulsory for all children. Thus, I define 'Matric' as individuals with at least 12 years of completed education and 'compulsory' as individuals with at least 9 years of completed education.

In Table 3.2, columns (4-6), education outcomes for post-reform cohorts for blacks suggest gain in education outcomes among blacks over pre-reform cohorts, on all measures of education, whilst for whites there is no change, which confirms the findings in the previous section. For example, blacks aged 5-18 in 1994, had 10.48 years of completed education. Whereas, whites, post-reform cohorts, received 12.65 years of completed education (cf. Columns (4-5) of Table 3.2). With respect to the household characteristics, there is some evidence to suggest that the difference in the mean of household size across the two races has become insignificant and smaller for cohorts likely to receive education after Apartheid (cf. Columns (4-5), Panel (B)). The household income for whites is higher than blacks for both pre and post-reform cohorts. However, among blacks, household income is similar for cohorts receiving education before and after 1994. The same is also true for whites (cf. Columns (1 and 3) and (2 and 4), Panel (B)). Since from the data, I cannot identify the respondent's childhood residence, I cannot rule out household characteristics as a potential confounder in determining years of education.

3. Effect on Education Outcomes

The question posed in this study is whether the end of Apartheid led to a convergence in education outcomes among blacks relative to whites, for those who were likely to be in school or start school at the time of the policy change in 1994. I present my empirical strategy in section 3.1 and the empirical results in section 3.2.

3.1 Empirical Strategy

The econometric framework is designed to compare education improvements among children between the two races before and after the policy change, after controlling for cohort and race fixed effects. As discussed in the preceding section, the treatment status is defined by two dimensions of variation, birth timing and race. I consider treated as blacks aged five to eighteen in 1994, while blacks aged nineteen to twenty-nine and whites aged five to twenty-nine are the controls. Below I refer to the 5-18 (19-29) group as the “younger” (“older”) cohorts. I estimate the effect of the end of Apartheid on two education outcomes, completed years of schooling and matriculation completion.

In particular, I estimate the following model,

$$S_{irt} = \beta_0 + \beta_1(Race_r \times Post_t) + \delta_t + \eta_r + \varepsilon_{irt} \quad (1)$$

where S_{irt} is the education outcome for individual ‘ i ’, of race ‘ r ’, at time, ‘ t ’. $Post_t=1$ for observations who were aged 5-18 in 1994 (post-reform cohorts), while $Post_t=0$ for individuals who were aged 19-29 in 1994 (pre-reform cohorts). $Race_r=1$ if an individual belongs to the “black African” race and is otherwise equal to 0 if belongs to the “white” race.

η_r includes race fixed-effects and δ_t includes the cohort fixed effects defined by the year of birth.¹⁴ ε_{irt} is an unobserved individual disturbance. The parameter of interest is β_1 in Eq. (1), which captures the change in average educational attainment between the ‘older’ and ‘younger’ cohorts among ‘blacks’ relative to ‘whites’.¹⁵ Since the reforms in 1994 were mainly aimed at blacks, it is possible that whites faced lower resources after Apartheid, in which case my coefficient of interest would be overstated. However, there is no evidence from Table 3.2 to show that whites did worse in their education outcomes after 1994.

To further refine variations across provinces and communities and to control for linear and sometimes quadratic race-specific trends, the strategy employed is:

$$S_{irt} = \beta_0 + \beta_1(Race_r x Post_t) + \delta_t + \eta_r + \phi_p + \omega_g + \mu_r t + \varepsilon_{irt} \quad (2)$$

where ϕ_p includes province specific fixed effects and ω_g includes ‘geography-type’ fixed effects.¹⁶ $\mu_r t$ indicates a race-specific linear trend.¹⁷ Robust standard errors are clustered at the provincial level. The coefficient of interest β_1 in Eq. (2) is expected to be positive if the demise of Apartheid led to improved education outcomes for blacks relative to whites. This

¹⁴ I use an individual’s age in the GHS 2013 data to identify their year of birth, and thus a cohort refers to individuals of the same age in the survey. As mentioned earlier, the sample includes only blacks and whites. Thus, the race fixed effects refer to these two groups only.

¹⁵ GHS-2013 does not ask individuals their mother’s and father’s education. Hence I could not use these as additional covariates.

¹⁶ According to the GHS, 2013, the settlements in South Africa are classified into four geography types: urban formal, urban informal, rural areas and tribal areas. Tribal areas refer to the tribal settlements/villages within rural areas in South Africa. For the purpose of this study, I have grouped urban formal and urban informal as one category, defining ‘geography type’ as 1 for urban settlements (urban formal and urban informal), 2 for rural settlements and 3 for tribal settlements.

¹⁷ I only include black Africans and whites for my study. Hence race here refers to the two population groups used in the study, black Africans and whites.

effect can be interpreted as causal as long as there are no race-cohort omitted variables affecting educational outcomes that are not captured by linear and sometimes quadratic race-specific time trends.

3.2 Empirical Results

Table 3.3 presents the regression results. All specifications from columns (1 - 5) include race and cohort fixed effects. Column (1) presents the baseline results based on Eq. (1) with cohort fixed-effects, which absorbs the time-varying unobserved differences across cohorts that are common to both races and race fixed effects which control for the time invariant unobserved differences across the two races. Results with time-invariant unobserved differences across provinces absorbed by province fixed effects are presented in Column (2). Column (3) additionally includes ‘geography-type’ fixed effects. Columns (4-5) further include linear and quadratic race-specific trends, respectively, which control for pre-existing time trends across the two races.

In Table 3.3, the point estimates in columns (1-3), suggest a statistically significant increase in the completed years of education for blacks relative to whites after the end of Apartheid. Specifically, in column (3), younger blacks who were aged 5-18 in 1994 have 1.2 more years of education in comparison to older blacks who were aged 19-29 in 1994, relative to whites. However, with the inclusion of linear race-specific trends in column (4), the point estimates become smaller in magnitude and are also not statistically different from zero, to suggest no positive and statistically significant gain in the completed years of education for blacks relative to whites after Apartheid, over and above the trends in education outcomes for blacks and whites. Specifically, estimates in column (4) suggest that compared to the older cohorts,

blacks after 1994 have an additional 0.16 years of education relative to whites. However, the estimates are not statistically different from zero. Further, in column (5), with the extended control for quadratic race-specific trends, the point estimates become smaller in magnitude and again are not statistically different from zero. The coefficients on the other covariates have the expected sign, with blacks in tribal and rural areas having lower completed years of education in comparison to blacks in urban areas (cf. Columns (3-5)).

Next, in Table 3.4, I report results by gender. The sample includes only boys in panel A and only girls in panel B. The results reveal qualitatively similar patterns for males and females, but somewhat larger point estimates and smaller standard errors for males than females after controlling for pre-existing linear and quadratic trends across the two races. Specifically, for boys, the point estimates are positive, suggesting a gain of 0.14 years in the completed years of education for blacks after Apartheid, relative to whites. For girls however, the point estimates are smaller, suggesting a gain of only 0.02 years (cf. Column (5), Panel (A and B)). However, as in Table 3.3, the point estimates lose statistical significance after controlling for linear and quadratic race-specific trends, for both males and females (cf. Columns (4 and 5), Panel (A and B)).

Tables A.1 and A.2 in the appendix show results of the robustness checks with alternative treatment and comparison groups. Table A.1, shows the estimates excluding individuals aged 5 from the treatment group as these individuals may have been affected by free access to health services post-Apartheid, resulting in any potentially positive effects of the end of Apartheid to be upward biased.¹⁸ Further, I also exclude individuals aged 19 and 20 years in

¹⁸ With the end of Apartheid, newly-elected South African government abolished user fees from health services for children under six years of age and for pregnant women at public facilities since June 1994 (Republic of South Africa, 1994 and Tanaka, 2014).

1994 from the comparison group, as their treatment status is unknown. In Table A.1, the point estimates have largely the same magnitude, with the exception of column (5), where the point estimates are somewhat larger in magnitude and have smaller standard errors, but again are not statistically different from zero. In addition, as a further robustness check, in Table A.2, I exclude individuals aged between 15-18 years from my treatment group. In comparison to Table 3.1, the point estimates now are larger in magnitude and remain statistically significant even after the inclusion of linear and quadratic race-specific time trends (cf. Columns (1-5) of Table A.2).

Due to the difference in completed years of education by gender as shown in Table 3.2, I report estimates of a linear probability model for matriculation status only by gender in Table 3.5. A dummy variable equal to one for people with twelve or more years of completed education and zero otherwise is regressed on the same set of explanatory variables. The sample focusses only on boys in panel A and only on girls in panel B. For the remaining tables I only show the coefficient on β_1 in Eq. (1) and (2).

In Table 3.5, the probability of achieving matriculation is about 8 percentage points higher for blacks after Apartheid, relative to whites (cf. Columns (1-3), Panel(A)). However, again comparing estimates from Table 3.5 with estimates from Table 3.1, the point estimates become smaller in magnitude and are statistically not different from zero after the inclusion of linear and quadratic race-specific trends (cf. Columns (4-5), Panel (A)). Specifically, in column (5), the point estimates suggest about a 6 percentage points higher likelihood of achieving matriculation for black African boys than the corresponding white cohorts. However, the point estimates are not statistically different from zero. Consistent with the previous findings, the point estimates for both boys and girls become smaller in magnitude

and lose statistical significance after controlling for linear and quadratic race-specific trends. Moreover, for girls, the point estimates have an unexpected sign after controlling for pre-existing trends in race (cf. Columns (4-5), Panel (B)). This may be due to the fact that the spread of HIV/AIDS in 1990's affected black women more in South Africa, resulting in girls dropping out from school before achieving matriculation.

To further explore heterogeneities in education outcomes defined across pre and post-reform cohorts, I run the following regression:

$$S_{irt} = \beta_0 + \sum_{l=1966}^{1989} (\text{yearofbirth}_{il} * \text{race}_r) \gamma_{il} + \phi_p + \omega_g + \varepsilon_{irt} \quad (3)$$

where yearofbirth_{il} is a binary variable that indicates whether a person 'i' is born in year 'l'. These unrestricted estimates provide the time dimension of exposure to the policy change in 1994 with 23 year of birth dummies, for being born between 1966 (aged 28 in 1994) and year 1989 (aged 5 in 1994). The omitted dummy is the dummy for individuals born in the year 1965. The individuals in my sample are aged twenty-four years or more and hence are likely to have completed their education at the time of the survey in 2013. The coefficient γ_{il} can then be interpreted as the estimate of the impact of the change in 1994 on a given cohort. Fig. 3.6 and 3.7 show the plots of the γ_{il} coefficient by gender for completed years of education. Each dot on the solid line plots the coefficient of the interaction between a given birth year and a dummy for race, which is one for blacks and zero for whites. The 95 percent confidence intervals are plotted as dashed lines. The coefficients are always above zero for each cohort for both boys and girls. The coefficients for the pre-reform cohorts are increasing and always greater than zero. This fact suggests that there was no apparent acceleration in

convergence for the treated cohorts after 1994. In other words, there is no evidence to suggest that the end of Apartheid had any effect on the education outcomes of blacks relative to whites over and above a longer-term trend, which is consistent with my findings in Tables 3.3-3.5.

One possible reason which could explain why I find little evidence of improvement in the education outcomes for blacks after 1994 relative to whites is the arrival of HIV in South Africa in the nineties. Several studies look at the effect of HIV/AIDS epidemic on human capital investment focusing on orphans.¹⁹ Based on the South African Census, 2001 an estimated 2.3 million children, representing 13.3 percent of all children in South Africa, under the age of eighteen lost either one or both their parents because of the HIV/AIDS epidemic (Case and Ardington, 2006). Children whose either one or both parents have died are less likely to be enrolled in school than non-orphans. Moreover, maternal orphans are likely to have completed fewer years of schooling than children whose mothers are alive (Case and Ardington, 2006; Case et al., 2004).

However, Fortson (2011) argues that HIV/AIDS epidemic may have affected human capital investment through other channels. First, the death risk due to the HIV/AIDS epidemic reduces the value of additional increases in earnings from an additional year of schooling. Fortson (2011) in the context of 15 countries in sub-Saharan Africa, using the cross-sections from the Demographic and Health Surveys finds that years of schooling, school attendance, primary school completion and progress through schools declined in places with high levels

¹⁹ The death of adults from HIV/AIDS results in pronounced concentrations of orphans, with a lack of support for the children orphaned by AIDS (Case et al., 2004).

of HIV. Second, the opportunity cost of a child's time may increase if he or she is needed to care for a terminally ill household member, raising the cost of schooling (Ainsworth et al., 2005). Third, on the supply side, the spread of the HIV/AIDS epidemic may have affected the provision of schooling based on the availability of trained and experienced teachers to deliver on the education reforms after 1994 as teachers left the education system because of illness or death. Fourth, high adult mortality from AIDS may have altered the scarcity of different kinds of labour, raising wages in jobs with insufficient manpower with ambiguous effects on the demand for schooling (Ainsworth et al., 2005). Fifth, since the epidemic affected the black population more, especially black females, the HIV/AIDS epidemic is likely to have eroded the gains through equitable distribution of resources, by ethnicity, set in the post-Apartheid policies (Jansen and Taylor, 2003).

The first case of HIV in South Africa was reported in 1982 which signaled the start of the HIV epidemic, which was initially limited to the gay community, blood transfusion recipients and haemophiliacs (Karim and Karim, 2002). Based on the annual Antenatal Survey reports, the HIV prevalence rates among pregnant women in South Africa rose from 0.76 percent in the year 1990 to 25 percent by the year 2000, far exceeding the forecasts for the growth of HIV infection rates during the nineties. Fig. 3.8 and 3.9 show the HIV prevalence rate from 1990 onwards. The data come from the UNAIDS AIDSinfo database on the HIV prevalence rate among individuals aged 15-49 in South Africa and from the Antenatal Surveys. The National Antenatal Sentinel HIV prevalence surveys for antenatal clinic attendees have been conducted in South Africa by the National Department of Health (DoH) since 1990. These surveys are carried out every year during the month of October across all the nine provinces of South Africa. Pregnant women aged 15-49 who attend antenatal clinics in the public health sector for the first time are requested to participate in these anonymous surveys (National Antenatal Sentinel HIV and Syphilis Prevalence Survey Report South Africa, various years).

The HIV prevalence rate by province is shown in Fig. 3.9. There is a rising trend in the HIV prevalence rate across all the nine provinces from 1990 onwards. However, there is heterogeneity in the spread of HIV prevalence rate across the nine provinces. The growth in the HIV prevalence rate was the fastest in the province of KwaZulu Natal. In contrast the Western Cape Province has the lowest HIV prevalence rate over the period 1990 to 2010. The corresponding HIV prevalence rates across the 9 provinces of South Africa are shown in Table 3.6. Consistent with Fig. 3.9, Table 3.6 shows considerable variation in HIV prevalence rates across the nine provinces of South Africa during this period.

I cannot address the issue of potential bias in my results, due to the effect of HIV/AIDS on education outcomes because of the shortcomings of the data. First, estimates of provincial HIV prevalence rate in South Africa are unavailable prior to 1990. As the cohorts in the sample are aged twenty-four years or more at the time of the survey, I cannot match the provincial HIV prevalence estimates to the education outcomes of the cohorts in the study.²⁰ Second, since the data include information about a respondent's current region of residence but do not have information about their region of residence during their schooling years, I cannot identify the effect of HIV on education outcomes as it depends on my ability to match individuals to the HIV rates in provinces during their schooling years, which could otherwise lead to a potential bias in my results due to migration.

²⁰ Specifically, using a DDD strategy interacting the post-reform black cohorts with a dummy for HIV prevalence rate (which is one for the high HIV prevalence rate provinces and 0 for provinces with low HIV prevalence rate) requires knowing the HIV prevalence rate before the 1990s', as the cohorts in the control group were born between the years 1965 and 1975. Data on the HIV prevalence rate in South Africa is not available prior to the 1990's.

4. Robustness Checks

As with most non-experimental studies, the treatment status in my study is not random, which may lead to correlations between the treatment status and the error term. The main analysis in this study is based on the identification assumption that, after controlling for cohort fixed effects and race fixed effects, the change in access to education inputs after the end of Apartheid was as good as randomly allocated. However, there are concerns that the identification assumption might be violated and, in the subsections below, I try to investigate the robustness of the findings to alternative specifications using various placebo tests.

4.1 Pre-existing trends in education

A key assumption in the difference-in-differences analysis is that the underlying trends of the two groups considered should be similar. In particular, the identification strategy rests on the assumption that there would have been no difference in the change over time in the educational outcomes of blacks relative to whites, had Apartheid not ended in 1994. If this assumption is violated my difference-in-differences estimates will be biased. I include race-specific linear and quadratic time trends in the difference-in-differences specification to partially address this issue. Second, I conduct placebo tests to check for pre-existing differences in trends in education between blacks and whites, which could violate the common trends assumption of the difference-in-differences strategy.

Fig. 3.10 and 3.11 show the trends in completed years of education and matriculation or higher for blacks and whites aged five to twenty-nine in 1994. The vertical dashed line separates those who were likely to benefit, aged five to eighteen in 1994, and those not likely to benefit, aged nineteen to twenty-nine in 1994, from the policy change. For individuals

aged between nineteen and twenty-nine in 1994, there are substantial differences in the years of education and matriculation between blacks and whites. However, the graphs suggest a positive trend in the education outcomes for blacks, relative to whites, over time. As expected, there is no sharp rise or fall in the education outcomes of whites at the time of the reform. However, for blacks, aged five to eighteen in 1994, who were likely to benefit from post-Apartheid policies, there appears to be a slowdown in the increase in education outcomes after the demise of Apartheid. For example, blacks aged 17 in the year 1994, observed in the GHS 2013, have an average of 10 completed years of education. However, blacks aged 5 in the year 1994 (who are likely to attend school after the demise of Apartheid), observed in the GHS 2013 survey, have 10.5 years of completed education. Similarly, for matriculation, blacks aged 18 in the year 1994, observed in the GHS 2013 survey, 40 percent have attained matriculation. However, for blacks aged 5 in 1994 (who are likely to attend school after the end of Apartheid), observed in the GHS 2013 survey, only 45 percent have attained matriculation. The graphs suggest a slowdown in the convergence in education outcomes between blacks and whites after the demise of Apartheid.

Tables 3.7 and 3.8 show the corresponding regression results for convergence in education outcomes between blacks and whites for the pre-reform cohorts, as depicted in Fig. 3.10 and 3.11. I compare individuals aged five to eighteen with individuals aged nineteen to twenty-nine, with 1965 and 1977, 1978, until 1981 as the pseudo reform years.²¹ If there are any differential time trends between blacks and whites, then we may see spurious effects in the years prior to the 1994 reforms.

²¹ I conduct placebo tests for pre-reform years prior to 1982 as individuals born in or after 1982 are likely to have benefitted from the actual policy reforms in 1994.

In Tables 3.7-3.8, the difference-in-differences estimates are consistently large in magnitude and statistically significant across various specifications for various pseudo reform years, on both measures of education outcome (cf. Columns (1-5)). Also, in contrast to the estimates in Tables 3.3-3.5, the point estimates are larger in magnitude and statistically significant even after the inclusion of linear and quadratic race-specific trends (cf. Columns (4-5) of Tables 7 and 8). One exception is however, when I use 1965 as the pseudo reform year, where the results on matriculation completion do not suggest a positive increase in the likelihood of achieving matriculation for blacks relative to whites (cf. Columns (1-5) of Table 3.8). However, the point estimates are positive and statistically significant for the other measure of education, completed years of education, with 1965 as the pseudo reform year (cf. Columns (1-5) of Table 3.7). These findings suggest that black children were gaining in their education outcomes, relative to whites, before the end of Apartheid. Louw et al. (2007) indicate improvement in inter-generational social mobility, influenced by educational status, within race groups over the period 1970 to 2001, resulting in a partial convergence in the years of education completed between blacks and whites. Similarly, Thomas (1996) finds improved inter-generational mobility in South Africa through positive effects of parental education on their children's education outcomes, which resulted in convergence in education outcomes among blacks and whites, even before Apartheid began to be dismantled.

Taken together, the evidence does not suggest that the end of Apartheid had any effect on the education outcomes of blacks relative to whites over and above a longer-term trend. For whites, as expected, there was no change in education outcomes after 1994. In contrast, there appears to have been a partial convergence in the education outcomes between blacks and whites during the later years of Apartheid, with the rate of convergence in the education

outcomes between blacks and whites actually slowing down after the fall of Apartheid. There could be a few possible explanations behind these findings. First, the study does not include cohorts born after 1989. It is likely that the rise in education outcomes was sharper for blacks aged four or younger in 1994. Since I use the GHS 2013 survey which is the latest in the series of the GHS surveys for individuals with completed years of education at the time of the survey in 2013, the study only looks at individuals who were aged five or older in 1994. Second, the positive effects of the end of Apartheid in 1994 on the education outcomes among blacks may be downward biased due to the outbreak of HIV in South Africa in the early nineties. Third, during the late 1990's the South African government implemented policies to restrict over-age and under-age school enrolments and imposed restrictions on the number of times children could repeat grades. The effect of these policies was a dramatic fall in the growth of primary and secondary school enrolments between 1997 and 2000 (Burger et al., 2012).

5. Conclusion

The economic literature on the impact of the fall of Apartheid on the education outcomes for blacks is scarce despite the fact that the demise of Apartheid was an extraordinary event in the history of South Africa. The analysis in this paper exploits the fact that the fall of Apartheid can be seen as an exogenous event, to compare the education outcomes of blacks relative to whites after the fall of Apartheid, using the fact that during Apartheid there was discrimination against blacks and not whites. Specifically, I use a difference-in-differences strategy to test for convergence in education outcomes for blacks relative to whites after 1994.

Results suggest that the end of the laws which discriminated by race, with the fall of Apartheid, resulted in no gain in the completed years of education among blacks, who are likely to be in school after the fall of Apartheid, relative to whites. Exploring the results by gender and using matriculation or higher as a measure of education, again suggests no statistically significant gain in the rate of matriculation completion among black African men after 1994. For black African women, point estimates suggest a fall in the matriculation rate after 1994 though the coefficients are not statistically different from zero.

Using alternative pieces of evidence to further examine the results, I find partial convergence in education outcomes among blacks and whites during Apartheid, on both measures of education outcomes. There is some evidence to suggest that convergence in the differential years of education and matriculation rate between blacks and whites may have actually slowed down after the end of Apartheid. These results could be explained in the light of the fact that there was an outbreak of HIV in South Africa from 1990 onwards, mainly affecting

young people, especially women. The outbreak of HIV in South Africa may have changed the perception of individuals of future returns to education (Jansen and Taylor, 2003).

Second, towards the late nineties the Department of Education of the Republic of South Africa implemented two policies to restrict over-age and under-age learners in South African schools and imposed restrictions on the number of times a learner could repeat grades. Further research is needed to estimate the importance of these two events, after the demise of Apartheid in South Africa, in explaining the gap in education outcomes among blacks and whites.

6. APPENDIX

Table A.1 Regression Results on effects of end of Apartheid on completed years of education (Robustness check-1)

Dependent variable					
Completed years of education					
variables	(1)	(2)	(3)	(4)	(5)
Black African X Post	1.169*** (0.200)	1.223*** (0.218)	1.221*** (0.212)	0.171 (0.134)	0.122 (0.123)
Observations	24309	24309	24309	24309	24309
R²	0.10	0.12	0.13	0.13	0.13
Cohort FE	Yes	Yes	Yes	Yes	Yes
Race FE	Yes	Yes	Yes	Yes	Yes
Province FE	No	Yes	Yes	Yes	Yes
Geography type FE	No	No	Yes	Yes	Yes
Linear Race Trends	No	No	No	Yes	Yes
Quadratic Race Trends	No	No	No	No	Yes

Notes: This table reports the effect of 1994 reforms on Completed years of education. The sample includes children aged 21-29 in 1994 (pre-reform cohorts) and children aged 6-18 in 1994 (post-reform cohorts). Robust standard errors clustered at the provincial level in parentheses. The dependent variable is completed years of education. All specifications in columns 1-5 include cohort fixed effects, and race fixed effects in columns (1-3). * Significant at 10 percent level, ** Significant at 5 percent level, *** Significant at 1 percent level

Table A.2 Regression Results on effects of end of Apartheid on completed years of education (Robustness check-2)

Dependent variable					
Completed years of education					
variables	(1)	(2)	(3)	(4)	(5)
Black African X Post	1.437*** (0.222)	1.509*** (0.241)	1.511*** (0.233)	0.683*** (0.172)	0.667*** (0.162)
Observations	19941	19941	19941	19941	19941
R²	0.11	0.13	0.13	0.13	0.13
Cohort FE	Yes	Yes	Yes	Yes	Yes
Race FE	Yes	Yes	Yes	Yes	Yes
Province FE	No	Yes	Yes	Yes	Yes
In Geography type FE	No	No	Yes	Yes	Yes
Linear Race Trends	No	No	No	Yes	Yes
Quadratic Race Trends	No	No	No	No	Yes

Notes: This table reports the effect of 1994 reforms on Completed years of education. The sample includes children aged 21-29 in 1994 (pre-reform cohorts) and children aged 5-14 in 1994 (post-reform cohorts). Robust standard errors clustered at the provincial level in parentheses. The dependent variable is completed years of education. All specifications in columns 1-5 include cohort fixed effects, and race fixed effects in columns (1-3). * Significant at 10 percent level, ** Significant at 5 percent level, *** Significant at 1 percent level

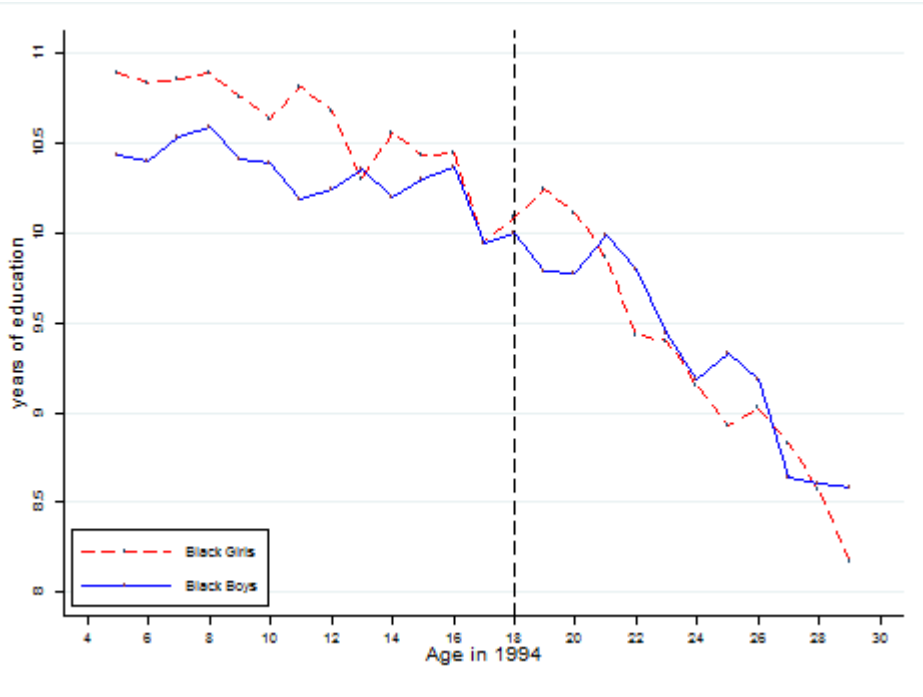


Figure A.1: Completed years of Education by gender and Age in 1994 for Blacks

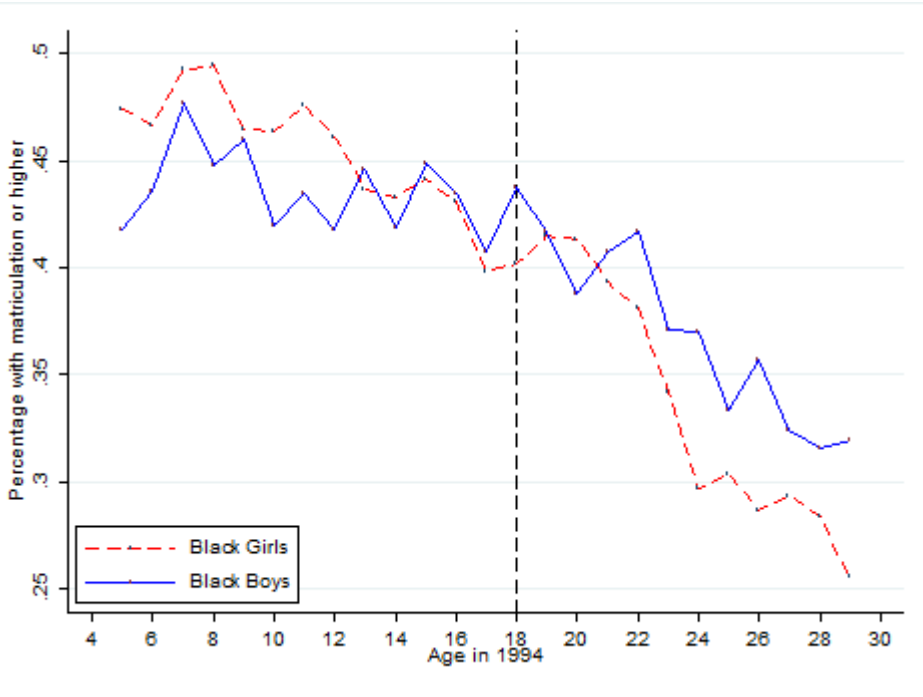


Figure A.2: Matriculation rate (Percentage) by gender and Age in 1994 for Blacks

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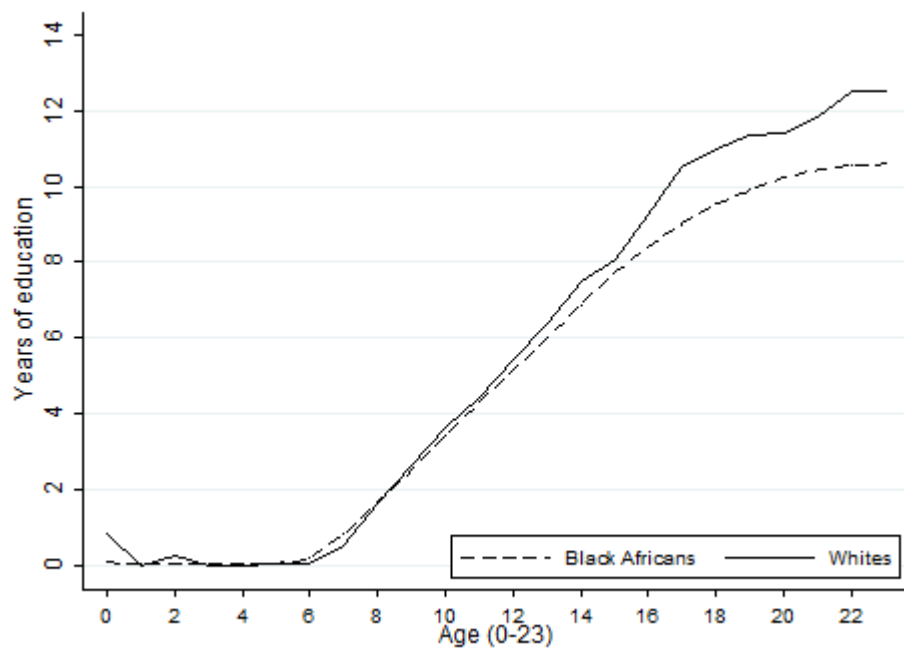


Figure 0.1: Average years of Education by Age and Race, Ages 0-23.

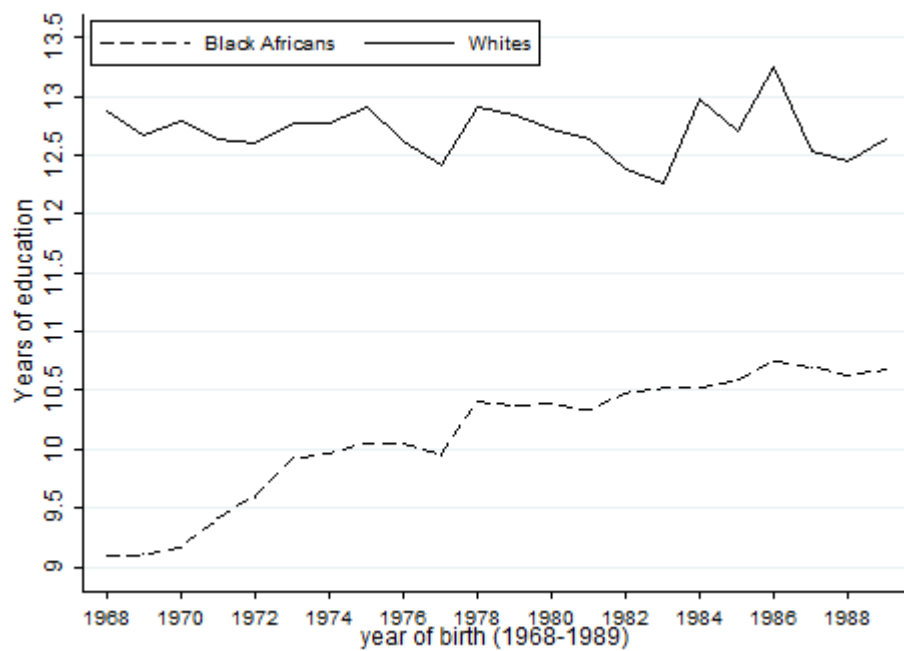


Figure 0.2: Average years of Education by year of birth and Race, Age (24-45 in 2013)

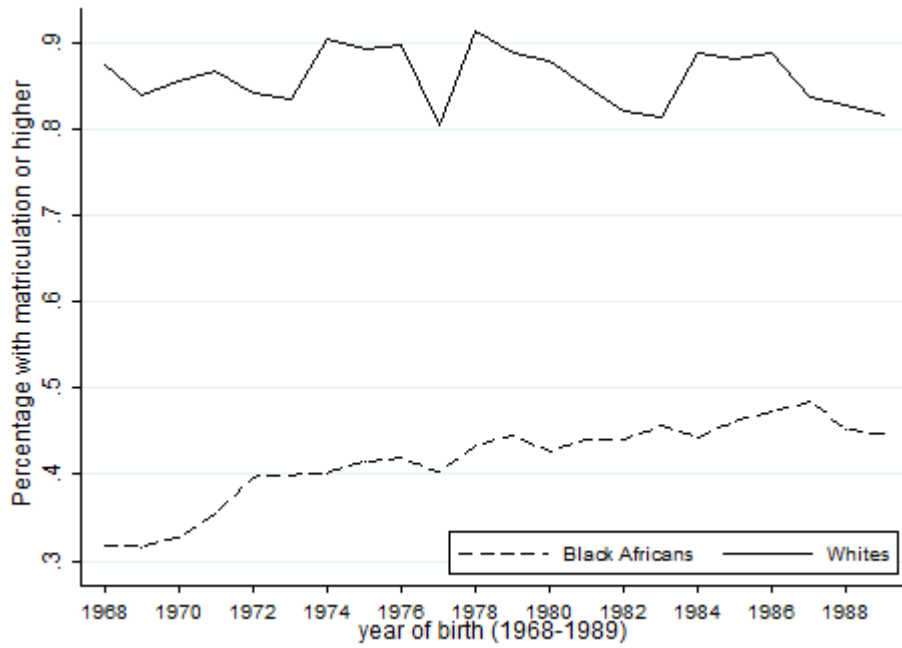


Figure 0.3: Matriculation rate (percentage) by year of birth and Race, Ages (24-45 in 2013)

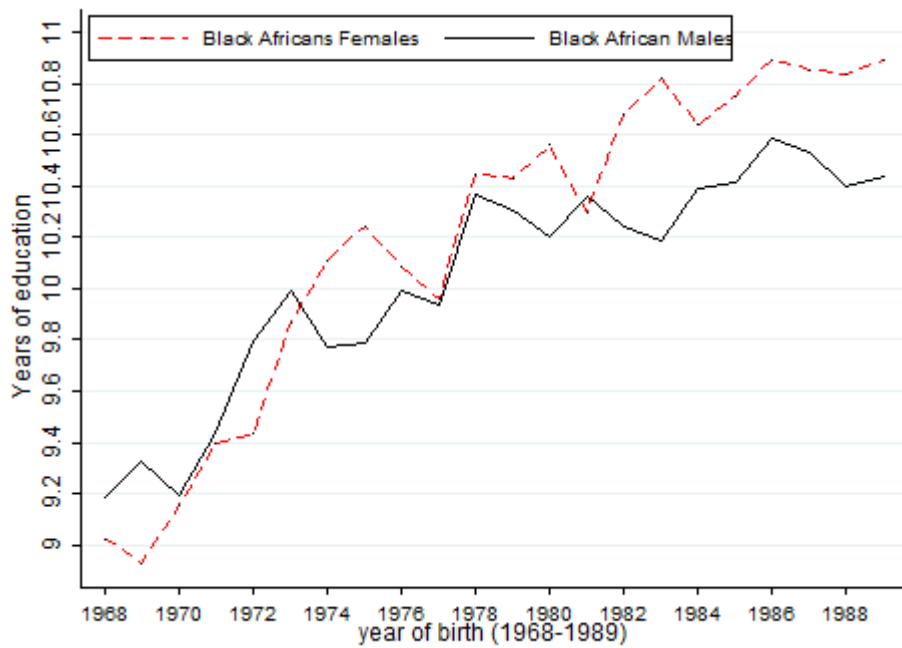


Figure 0.4: Average years of Education completed for black Africans by sex and year of birth, Ages (24-45 in 2013)

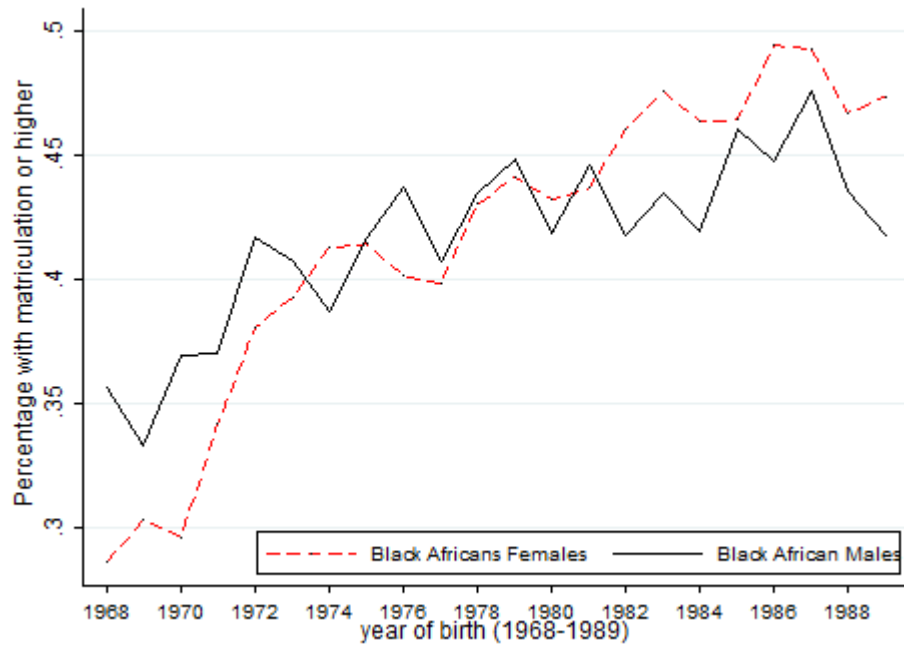


Figure 0.5: Matriculation rate (percentage) for black Africans by Gender & year of birth, Ages (24-45 in 2013)

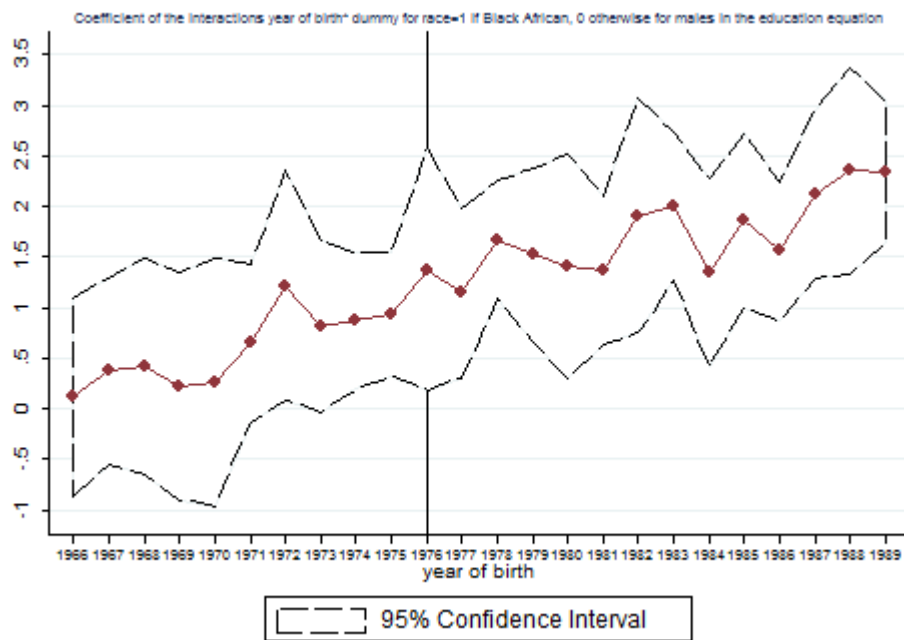


Figure 0.6: Coefficients from the education equation, on the interaction of year of birth with the dummy for race=1 for blacks and 0 for whites, for males.

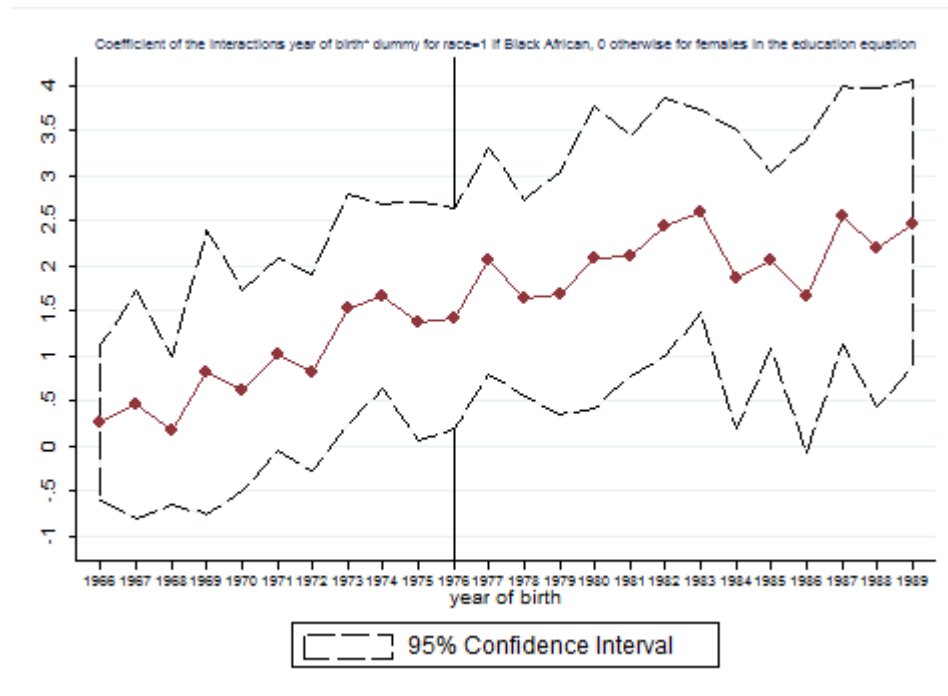


Figure 0.7: Coefficients from the education equation, on the interaction of year of birth with the dummy for race=1 for blacks and 0 for whites, for females.

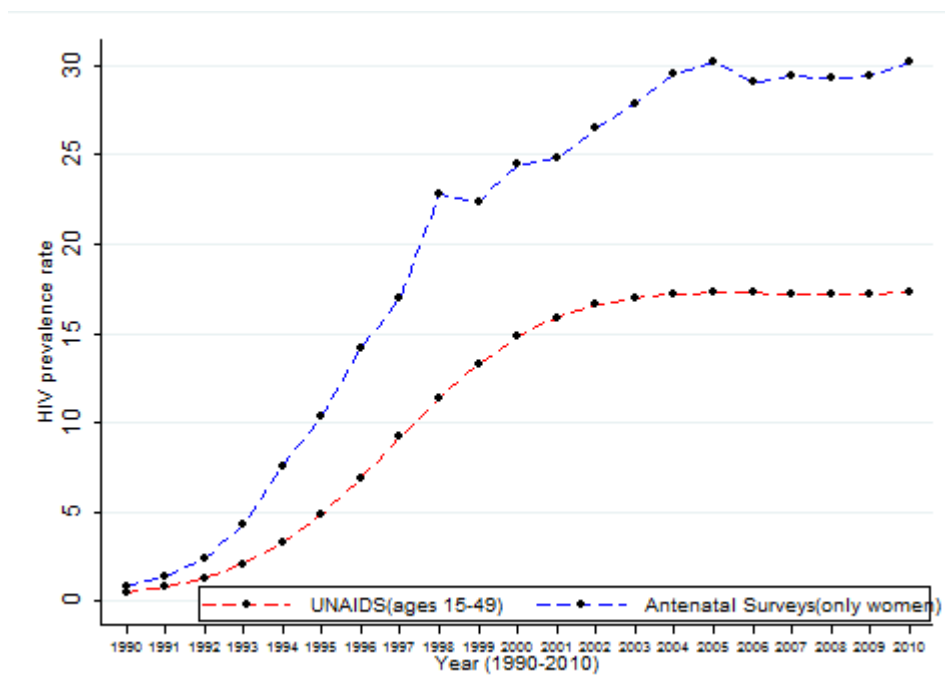


Figure 0.8: HIV prevalence Rate-South Africa (Years 1990-2010)

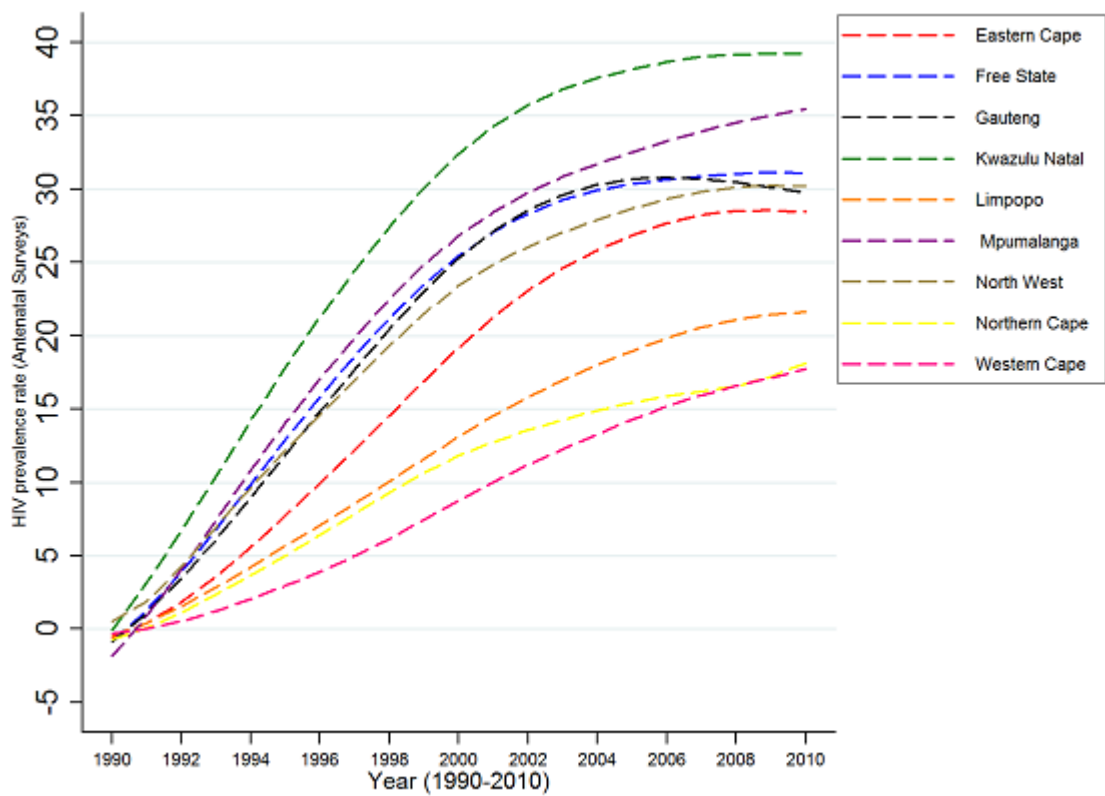


Figure 0.9: HIV prevalence rate by Province- South Africa (Years 1990-2010)

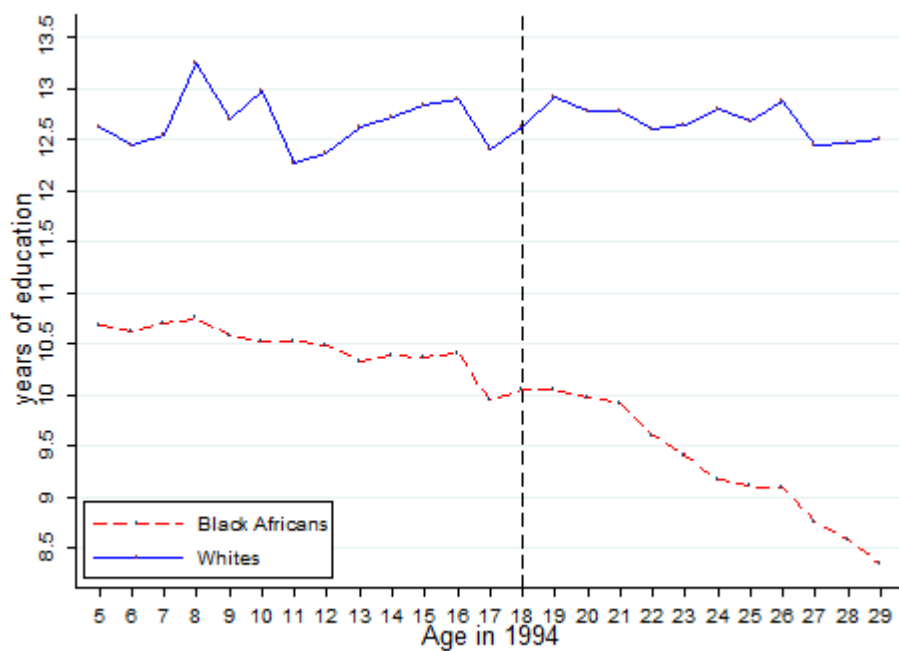


Figure 0.10: Completed years of education by Race and Age in 1994

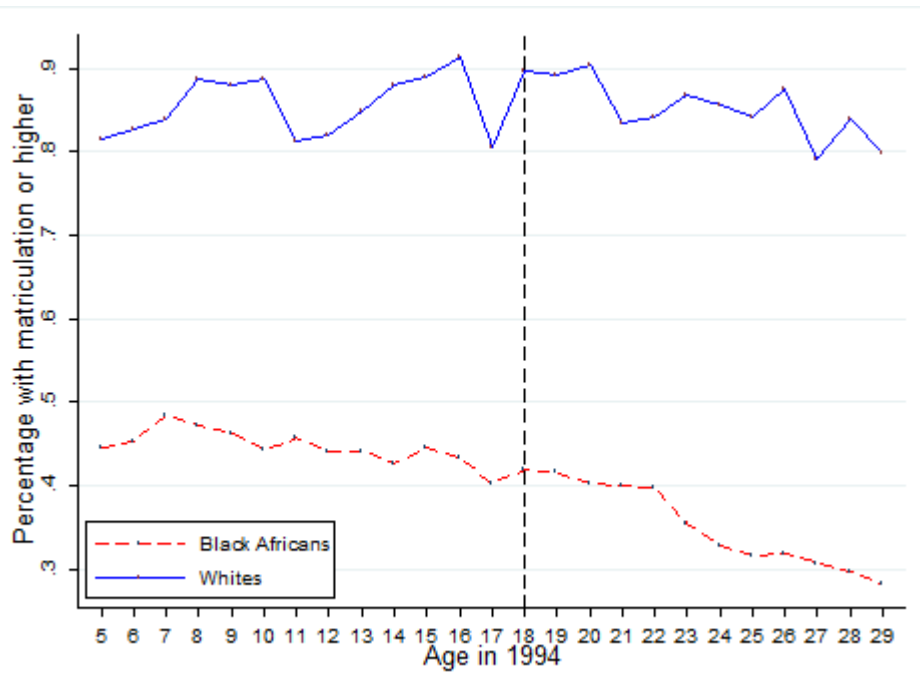


Figure 0.11: Percentage with Matriculation or higher by Race and Age in 1994

Table 0.1- School Enrolment by Race (Blacks and Whites)

Age	School Enrolment by Race- 1994, 2013							
	1994				2013			
	Black African		whites		Black African		whites	
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
	Percent Enrolled	Percent with Matriculation	Percent Enrolled	Percent with Matriculation	Percent Enrolled	Percent with Matriculation	Percent Enrolled	Percent with Matriculation
5	0.30	0.00	0.10	0.00	0.88	0.00	0.83	0.00
6	0.69	0.00	0.39	0.00	0.96	0.00	0.92	0.00
7	0.88	0.00	0.95	0.00	0.99	0.00	0.98	0.00
8	0.93	0.00	0.98	0.00	0.99	0.00	1.00	0.00
9	0.95	0.00	0.99	0.00	0.99	0.00	1.00	0.00
10	0.96	0.00	0.99	0.00	0.99	0.00	0.97	0.00
11	0.97	0.00	0.99	0.00	0.99	0.02	1.00	0.04
12	0.97	0.00	0.99	0.00	0.99	0.02	1.00	0.02
13	0.96	0.00	0.99	0.00	0.99	0.02	1.00	0.03
14	0.96	0.00	1.00	0.00	0.98	0.01	0.96	0.08
15	0.93	0.00	0.99	0.00	0.96	0.02	0.97	0.02
16	0.89	0.00	0.97	0.00	0.94	0.02	0.98	0.03
17	0.85	0.00	0.96	0.00	0.89	0.04	0.93	0.12
18	0.79	0.00	0.79	0.02	0.77	0.11	0.75	0.29
19	0.70	0.00	0.48	0.05	0.59	0.25	0.56	0.75
20	0.60	0.01	0.38	0.08	0.42	0.33	0.54	0.84
21	0.51	0.01	0.34	0.14	0.30	0.43	0.34	0.85
22	0.39	0.02	0.21	0.22	0.21	0.43	0.31	0.91
23	0.35	0.04	0.16	0.21	0.14	0.45	0.23	0.84
24	0.28	0.05	0.14	0.30	0.09	0.44	0.12	0.81

Percent with Matriculation is the percent of students currently enrolled in school with twelve or higher years of completed education.

Source: October Household Survey (1994), General Household Survey (2013)

Table 0.2- Difference-in-Differences Matrix by Cohort and Treatment Status- Black Africans and Whites

Variables	Before 1994			After 1994		
	Black African	whites	Difference	Black African	whites	Difference
Panel A: Individual Characteristics						
Age	42.68 [3.19]	42.87 [3.06]	-0.193* (0.09)	29.86 [3.98]	30.85 [3.97]	-0.990*** (0.123)
Percentage of Females	0.57 [0.49]	0.50 [0.50]	0.066*** (0.01)	0.52 [0.49]	0.49 [0.50]	0.031** (0.015)
Completed years of education	9.32 [3.67]	12.68 [2.09]	-3.354*** (0.109)	10.48 [2.65]	12.64 [2.14]	-2.157*** (0.081)
Percentage with Matriculation	0.34 [0.47]	0.85 [0.36]	-0.508*** (0.014)	0.44 [0.49]	0.85 [0.35]	-0.414*** (0.015)
Percentage with Compulsory education	0.67 [0.47]	0.98 [0.15]	-0.303*** (0.013)	0.84 [0.36]	0.97 [0.15]	-0.134*** (0.011)
Observations	7972	1173		15492	1114	
Panel B: Household Characteristics						
Monthly Household Income (logs)	8.2 [1.54]	9.9 [0.91]	-1.665*** (0.06)	8.1 [1.7]	9.9 [0.88]	-1.80*** (0.08)
Household size	3.73 [2.21]	3.29 [1.36]	0.438*** (0.091)	2.8 [1.8]	2.7 [1.3]	0.108 (0.092)
Percentage with female HH head	0.45 [0.49]	0.16 [0.37]	0.289*** (0.02)	0.37 [0.48]	0.16 [0.37]	0.21*** (0.02)
Percentage of Urban households	0.61 [0.48]	0.94 [0.23]	-0.323*** (0.02)	0.65 [0.48]	0.92 [0.26]	-0.278*** (0.02)
Percentage of tribal households	0.34 [0.47]	0 [0]	0.344*** (0.01)	0.31 [0.46]	0 [0]	0.305*** (0.02)
Percentage of rural households	0.04 [0.18]	0.06 [0.23]	-0.021*** (0.01)	0.05 [0.21]	0.08 [0.26]	-0.027** (0.01)
Observations	4550	617		5016	399	

Notes: The table provides the summary statistics of variable means for the sample of individuals aged 5-18 (1976-1989) in 1994 (post-reform cohorts) and individuals aged 19-29 (1965-1975) in 1994 (pre-reform cohorts). Observations are at the individual level for Panel A and the household level for Panel B. The second column uses the sample for black Africans and the third column uses the sample for the whites and the last column estimates the differences in means between the two ethnicities under the null hypothesis that the difference in mean is equal to zero. Standard deviations are in square brackets and standard errors in parentheses. * Significant at 10 percent level, ** Significant at 5 percent level, *** Significant at 1 percent level.

Table 0.3-Regression Results on effects of end of Apartheid on completed years of education

Dependent Variable					
Completed years of education					
variables	(1)	(2)	(3)	(4)	(5)
Black African X Post	1.185*** (0.198)	1.247*** (0.213)	1.206*** (0.194)	0.156 (0.161)	0.067 (0.139)
Tribal			-1.257*** (0.226)	-1.257*** (0.226)	-1.258*** (0.226)
Rural			-1.994*** (0.235)	-1.998*** (0.232)	-1.999*** (0.231)
Observations	25751	25751	25751	25751	25751
R²	0.10	0.12	0.15	0.15	0.15
Cohort FE	Yes	Yes	Yes	Yes	Yes
Race FE	Yes	Yes	Yes	Yes	Yes
Province FE	No	Yes	Yes	Yes	Yes
Geography type FE	No	No	Yes	Yes	Yes
Linear Race Trends	No	No	No	Yes	Yes
Quadratic Race Trends	No	No	No	No	Yes

Notes: This table reports the effect of 1994 reforms on Completed years of education. The sample includes children aged 19-29 in 1994 (pre reform cohorts) and children aged 5-18 in 1994 (post reform cohorts). Black African is a dummy=1 for blacks and 0 for whites. Post is dummy=1 for post-reform cohorts and 0 for pre-reform cohorts. Robust standard errors clustered at the provincial level in parentheses. The dependent variable is completed years of education. All specifications in columns 1-5 include cohort fixed effects, and race fixed effects in columns 1-3. * Significant at 10 percent level, ** Significant at 5 percent level, *** Significant at 1 percent level

Table 0.4- Regression Results on effects of end of Apartheid on completed years of education by Gender

Dependent variable					
Completed years of education					
variables	(1)	(2)	(3)	(4)	(5)
<i>Panel A. Boys</i>					
Black African X Post	1.112*** (0.188)	1.194*** (0.188)	1.170*** (0.170)	0.178 (0.129)	0.146 (0.126)
Tribal			-1.326*** (0.268)	-1.327*** (0.268)	-1.327*** (0.268)
Rural			-2.175*** (0.309)	-2.179*** (0.308)	-2.179*** (0.308)
Observations	11924	11924	11924	11924	11924
R²	0.09	0.11	0.15	0.15	0.15
<i>Panel B. Girls</i>					
Black African X Post	1.243*** (0.255)	1.290*** (0.280)	1.240*** (0.258)	0.141 (0.253)	0.015 (0.225)
Tribal			-1.20*** (0.230)	-1.203*** (0.230)	-1.204*** (0.230)
Rural			-1.790*** (0.214)	-1.794*** (0.210)	-1.795*** (0.210)
Observations	13827	13827	13827	13827	13827
R²	0.10	0.13	0.15	0.15	0.15
Cohort FE	Yes	Yes	Yes	Yes	Yes
Race FE	Yes	Yes	Yes	Yes	Yes
Province FE	No	Yes	Yes	Yes	Yes
Geography type FE	No	No	Yes	Yes	Yes
Linear Race Trends	No	No	No	Yes	Yes
Quadratic Race Trends	No	No	No	No	Yes

Notes: This table reports the effect of 1994 reforms on Completed years of education by gender. The sample includes children aged 19-29 in 1994 (pre reform cohorts) and children aged 5-18 in 1994 (post reform cohorts). Black African is a dummy=1 for blacks and 0 for whites. Post is dummy=1 for post-reform cohorts and 0 for pre-reform cohorts. Robust standard errors clustered at the provincial level in parentheses. The dependent variable is completed years of education. All specifications in columns 1-5 include cohort fixed effects, and race fixed effects in columns 1-3. * Significant at 10 percent level, ** Significant at 5 percent level, *** Significant at 1 percent level

Table 0.5- Regression Results on effects of end of Apartheid on probability of matriculation by Gender

Dependent variable					
Matriculation-Twelve or more years of completed education					
variables	(1)	(2)	(3)	(4)	(5)
<i>Panel A: Boys</i>					
Black African X Post	0.080*** (0.022)	0.087*** (0.021)	0.083*** (0.019)	0.052 (0.052)	0.063 (0.048)
Observations	11924	11924	11924	11924	11924
R²	0.07	0.07	0.07	0.09	0.11
<i>Panel B. Girls</i>					
Black African X Post	0.103** (0.033)	0.103** (0.034)	0.097** (0.034)	-0.058 (0.035)	-0.061 (0.033)
Observations	13827	13827	13827	13827	13827
R²	0.08	0.09	0.11	0.11	0.11
Cohort FE	Yes	Yes	Yes	Yes	Yes
Race FE	Yes	Yes	Yes	Yes	Yes
Province FE	No	Yes	Yes	Yes	Yes
Geography type FE	No	No	Yes	Yes	Yes
Linear Race Trends	No	No	No	Yes	Yes
Quadratic Race Trends	No	No	No	No	Yes

Notes: This table reports the effect of 1994 reforms on the probability of Matriculation by gender. The sample includes children aged 19-29 in 1994 (pre reform cohorts) and children aged 5-18 in 1994 (post reform cohorts). Robust standard errors clustered at the provincial level in parentheses. The dependent variable is Matriculation; percentage of children with twelve or more years of education. All specifications in columns 1-5 include cohort fixed effects, and race fixed effects in columns (1-3). * Significant at 10 percent level, ** Significant at 5 percent level, *** Significant at 1 percent level

Table 0.6- HIV Prevalence Rate by Province

HIV PREVALENCE RATE					
1990-2010 (11 years)					
Provinces	Mean	Standard Dev.	25 th Percentile	Median	75 th Percentile
western Cape	8.64	6.59	1.7	8.6	15.3
Northern Cape	10.24	6.56	5.3	10.5	16.2
Limpopo/Northern	12.25	7.91	4.9	13.2	20.4
Eastern Cape	17.19	11.21	6	20	28
Free State	21.44	11.55	11	27.9	30.1
KwaZulu Natal	27.71	13.71	18.47	33.5	38.7
North west	20.27	11.02	8.3	25.1	29.6
Gauteng	21.1	11.89	12	29.4	30.4
Mpumalanga	23.07	12.59	15.8	29.2	32.6

Notes: The table shows the detailed summary statistics for provincial HIV prevalence rate every year from 1990 to 2010, expressed in percentage points. The unit of observation is province. These HIV rates are taken from the National Antenatal Surveys (various years) conducted by the Department of Health (DoH), Republic of South Africa.

Table 0.7- Placebo effects in difference-in-differences model (Completed years of education)

Variables	Dependent Variable				
	Completed years of education				
	(1)	(2)	(3)	(4)	(5)
Placebo (1)					
Black African X Post 1981	2.109*** (0.162)	2.009*** (0.193)	1.965*** (0.179)	1.949*** (0.178)	1.956*** (0.183)
Observations	18674	18674	18674	18674	18674
R ²	0.22	0.24	0.28	0.28	0.28
Placebo (2)					
Black African X Post 1980	2.124*** (0.161)	2.033*** (0.195)	1.989*** (0.183)	1.976*** (0.181)	1.979*** (0.185)
Observations	18161	18161	18161	18161	18161
R ²	0.23	0.25	0.29	0.29	0.29
Placebo (3)					
Black African X Post 1979	2.190*** (0.171)	2.097*** (0.202)	2.050*** (0.207)	2.036*** (0.204)	2.038*** (0.208)
Observations	17680	17680	17680	17680	17680
R ²	0.23	0.26	0.3	0.3	0.3
Placebo (4)					
Black African X Post 1978	2.237*** (0.174)	2.153*** (0.189)	2.077*** (0.196)	2.063*** (0.193)	2.062*** (0.194)
Observations	17179	17179	17179	17179	17179
R ²	0.24	0.27	0.30	0.30	0.30
Placebo (5)					
Black African X Post 1977	2.317*** (0.181)	2.216*** (0.190)	2.132*** (0.206)	2.110*** (0.200)	2.106*** (0.200)
Observations	16712	16712	16712	16712	16712
R ²	0.25	0.27	0.31	0.31	0.31
Placebo (6)					
Black African X Post 1965	1.555*** (0.300)	1.387*** (0.262)	1.230*** (0.280)	1.220*** (0.275)	1.214*** (0.277)
Observations	10670	10670	10670	10670	10670
R ²	0.33	0.37	0.4	0.4	0.4
Cohort FE	Yes	Yes	Yes	Yes	Yes
Race FE	Yes	Yes	Yes	Yes	Yes
Province FE	No	Yes	Yes	Yes	Yes
Geography type FE	No	No	Yes	Yes	Yes
Linear Race Trends	No	No	No	Yes	Yes
Quadratic Race Trends	No	No	No	No	Yes

Notes: The results presented here lists the coefficients on the difference-in-differences specifications which include placebo tests for treatment effects in the pre-reform years, 1965 and 1977, 1978 until 1981 (addressing for pre-existing trends). Individuals aged 5-18 are compared with individuals aged 19-29 in each of these years. All regressions in columns (1-5) include cohort fixed effects, and race fixed effects in columns (1-3). Robust standard errors are clustered on the province. * Significant at 10 percent level, ** Significant at 5 percent level, *** Significant at 1 percent level.

Table 0.8- Placebo effects in difference-in-differences model (Matriculation)

	Dependent Variable				
	Matriculation Completion				
variables	(1)	(2)	(3)	(4)	(5)
Placebo (1)					
Black African X Post 1981	0.092*** (0.025)	0.084** (0.025)	0.080** (0.026)	0.077** (0.025)	0.077** (0.025)
Observations	18674	18674	18674	18674	18674
R ²	0.20	0.21	0.22	0.23	0.23
Placebo (2)					
Black African X Post 1980	0.084*** (0.023)	0.075*** (0.022)	0.072** (0.023)	0.070** (0.022)	0.069** (0.022)
Observations	18161	18161	18161	18161	18161
R ²	0.21	0.22	0.23	0.23	0.23
Placebo 3					
Black African X Post 1979	0.087*** (0.020)	0.079*** (0.020)	0.075*** (0.021)	0.073*** (0.020)	0.073*** (0.019)
Observations	17680	17680	17680	17680	17680
R ²	0.22	0.23	0.24	0.24	0.24
Placebo (4)					
Black African X Post 1978	0.090*** (0.021)	0.084*** (0.019)	0.079*** (0.020)	0.076*** (0.020)	0.076*** (0.020)
Observations	17179	17179	17179	17179	17179
R ²	0.23	0.23	0.25	0.25	0.25
Placebo (5)					
Black African X Post 1977	0.085*** (0.016)	0.079*** (0.015)	0.073*** (0.016)	0.069*** (0.016)	0.069*** (0.015)
Observations	16712	16712	16712	16712	16712
R ²	0.24	0.24	0.26	0.26	0.26
Placebo (6)					
Black African X Post 1965	-0.014 (0.036)	-0.021 (0.032)	-0.028 (0.033)	-0.030 (0.032)	-0.030 (0.032)
Observations	10670	10670	10670	10670	10670
R ²	0.35	0.36	0.37	0.37	0.37
Cohort FE	Yes	Yes	Yes	Yes	Yes
Race FE	Yes	Yes	Yes	Yes	Yes
Province FE	No	Yes	Yes	Yes	Yes
Geography type FE	No	No	Yes	Yes	Yes
Linear Race Trends	No	No	No	Yes	Yes
Quadratic Race Trends	No	No	No	No	Yes

Notes: The results presented here lists the coefficients on the difference-in-differences specifications which include placebo tests for treatment effects in the pre-reform years, 1965 and 1977, 1978 until 1981 (addressing for pre-existing trends). Individuals aged 5-18 are compared with individuals aged 19-29 in each of these years. All regressions in columns (1-5) include cohort fixed effects, and race fixed effects in columns (1-3). Robust standard errors are clustered on the province. * Significant at 10 percent level, ** Significant at 5 percent level, *** Significant at 1 percent level.