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CREDIT CONSTRAINTS AND THE RACIAL GAP IN POST-SECONDARY EDUCATION IN SOUTH AFRICA

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Credit Constraints and the Racial Gap in Post-Secondary Education in South Africa
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ABSTRACT

This paper analyzes the impact of high school household income and scholastic ability on post-secondary enrollment in South Africa. Using longitudinal data from the Cape Area Panel Study (CAPS), we analyze the large racial gaps in the proportion of high school graduates who enroll in university and other forms of post-secondary education. Our results indicate that family background and high school achievement (measured by a literacy and numeracy exam and performance on the grade 12 matriculation exam) are strong predictors of post-secondary enrollment and statistically account for all of the black-white difference in enrollment. Controlling for parental education and baseline scholastic ability reduces the estimated impact of household income on university enrollment, though there continues to be an effect at the top of the income distribution. We also find evidence of credit constraints on non-university forms of post-secondary enrollment. Counterfactual estimates indicate that if all South Africans had the incomes of the richest whites, African university enrollment would increase by 65%, even without changing parental education or high school academic achievement. The racial gap in university enrollment would narrow only slightly, however as our results suggest that this gap in postsecondary enrollment results mainly from the large racial gap in high school academic achievement.

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One of the key issues in economic research on post-secondary education is the extent to which credit constraints limit the ability of children from low-income families to attend university. While there is clear evidence that family income is strongly correlated with university attendance in a number of countries, there are different interpretations of what that correlation means. One interpretation is that low-income families cannot afford to pay tuition and other costs of post-secondary education, a problem that could potentially be solved through fee reductions or financial aid. Another interpretation is that there are long-term educational disadvantages from growing up in a low-income family because children attend lower quality schools and have access to fewer educational resources. Under the second interpretation the policy challenge is more difficult, since financial aid and reduced tuition will not be sufficient to compensate for the cumulative educational disadvantage faced by students from low-income families.

There has been considerable research on these issues in the United States. Using the National Longitudinal Survey of Youth (NLSY) 1979, Cameron and Heckman (2001) showed that the association between family income and college attendance was greatly reduced by controlling for Armed Forces Qualification Test (AFQT) scores. They concluded that the apparent effect of income is due more to early life resources than to credit constraints, and that these long-run factors, not credit constraints, explained most of the racial-ethnic differences in university enrollment. Carneiro and Heckman (2002) further showed that most of the income-college gradient could be explained by AFQT scores in the NLSY 1979 cohort. Keane and Wolpin (2001) also concluded that credit constraints had a small impact on college attendance, partly because low-income students are more likely to work. Updating this analysis with the 1997 cohort of the NLSY, Belley and Lochner (2007) found an increased impact of family income after controlling for AFQT scores. They concluded that credit constraints have become more important in the U.S. over time. Lochner and Monge-Naranjo (2011) developed a model of credit constraints and human capital, and showed that a combination of rising costs of university, rising returns to education, and slow growth of government student loans can explain why U.S. youth were not substantially constrained in the 1980s but are more constrained today. Further evidence of credit constraints in the U.S. is provided by Lovenheim (2011), who estimated that increases in house values caused increased college attendance among families that would otherwise have been credit constrained.

This paper looks at the extent to which credit constraints affect post-secondary education in

South Africa, with particular focus on the country's enormous racial gap in post-secondary enrollment. South Africa is an interesting setting in which to analyze the role of credit constraints in post-secondary education for several reasons. First, education levels are relatively high in the country, with almost universal primary education and with most students attending secondary school. The critical education margins are completion of secondary school and entry into post-secondary education. Second, the country has enormous income differences between rich and poor. These differences, which are strongly associated with race, are much larger than racial gaps in income in the U.S. Third, although most post-secondary education options are government funded, the cost of attending post-secondary institutions is high, at least in the absence of financial assistance. Issues of affordability may therefore play an important role in determining who is able to enroll.

A final consideration is that the legacy of apartheid's "Bantu education" system continues to manifest itself in large differences in the quality of primary and secondary schooling received by students from different race and income groups. The apartheid government ran separate school systems for different racial groups, with enormous differentials in funding levels and curriculum (Case and Deaton 1999, Fiske and Ladd 2004). Although government funding levels were equalized after 1994, there continue to be large racial differences in progress through school and ultimate educational attainment (Yamauchi 2005, Bhorat and Oosthuizen 2008, van der Berg 2007, Lam et al. 2011).

There is some evidence that credit constraints have an impact on post-secondary education in South Africa. Using a regression discontinuity design, Gurgand et al. (2011) found that applicants to the Eduloan student loan program who received a loan were 20 percentage points more likely to enroll in university than applicants who fell just short of the eligibility threshold. These results apply to the group that applies for Eduloan loans (discussed below), and thus exclude those who receive direct financial support from universities. Our analysis is based on a sample of all high school graduates in the Cape Town metropolitan area, and thus provides a broader picture of how credit constraints affect post-secondary enrollment.

We take advantage of rich longitudinal data from the Cape Area Panel Study (CAPS), a survey that began with 4,752 14-22 year-olds in metropolitan Cape Town in 2002. In addition to information on post-secondary education, household income, and other individual and household characteristics collected in each wave, CAPS administered a literacy and numeracy evaluation

(LNE) to all respondents in Wave 1. CAPS also collected detailed results on the standardized grade 12 matriculation exam in each wave. Following the approach of the U.S. literature, these LNE scores and matriculation exam scores allow us to control for high-school academic achievement in analyzing the income of household resources on post-secondary enrollment.

As in the U.S. literature, we find that the relationship between high school household income and university enrollment is greatly attenuated when we control for parental education and high school academic achievement. We continue to find an impact of income at the top of the income distribution, however, a possible indication that credit constraints play a role. A counterfactual in which everyone is given the income of the 90^{th} percentile whites, holding parental education and high school achievement constant, causes African (black) university enrollment to increase by 65%. The racial gap in enrollment remains very large, however, even with this extreme counterfactual which assumes that all remaining effects of income are due to credit constraints. An alternative counterfactual in which we give everyone the median test scores of whites, without changing incomes, has much larger effects, completely eliminating the racial gap in university enrollment. The results suggest that eliminating financial barriers to university would have only a small impact on the racial gap in enrollment, given that the gap results mainly from large racial disparities in high school academic achievement. We find evidence that other forms of post-secondary education may be more affected by credit constraints, however, and that these programs may have an important impact on earnings inequality.

The paper is organized as follows: Section 2 provides background on the disappointing trends in secondary and post-secondary education in South Africa since the end of apartheid, and documents the high returns to post-secondary education. Section 3 provides institutional background about South African higher education, including discussion of financial aid and affirmative action in admissions. Section 4 discusses the Cape Area Panel Study. Section 5 presents our main empirical analysis, including regressions that look at the impact of income on enrollment with and without controls for family background and test scores. Section 6 presents counterfactuals which provide a simple way of quantifying the potential role of credit constraints in explaining the racial gap in post-secondary enrollment. Section 7 reports on a number of robustness checks. Section 8 provides conclusions and discussion of policy implications.

I. The Racial Gap in Educational Attainment in South Africa

A major focus of this paper is the comparison of schooling outcomes for African, coloured, and white youths. These three population groups were subject to very different treatment under apartheid. Whites had advantages in a wide range of areas, including significantly higher expenditures on schooling, privileged access to the labor market, unrestricted residential mobility, and better access to social services. Africans had the least access to services and the most restrictions on work and migration, with a large gap in expenditures on schooling. The coloured population, which is heavily concentrated in the Western Cape (including Cape Town), occupied an intermediate status under apartheid, with higher expenditures on schooling, fewer restrictions on residential mobility, and better access to jobs than Africans.

Table 1 uses the nationally representative General Household Survey (GHS), collected by Statistics South Africa, to analyze trends in educational attainment for these three population groups for 25-29 year-olds from 2002 to 2010. Whites have a large advantage throughout the schooling distribution, although the gap has declined at lower levels. The percentage of Africans with less than grade 9 fell from around 26% in 2002-04 to around 20% in 2008-10.[1] This is a significant improvement in the bottom part of the schooling distribution, although Africans and coloureds still lag far behind whites in this part of the distribution.

There has been much less improvement at the top of the distribution. The proportion of Africans with at least grade 12 increased slightly – from 38.7% to 40.2%, far behind the 88% of whites who complete grade 12. The proportion of Africans going beyond grade 12 only increased from 7.4% to 8.3%, far below the 39% of whites who go beyond grade 12. Only 1.5% of 25-29 year-old Africans had a university degree in 2008-10, below the 2.3% in 2002-4. This compares to 18.3% of whites who had completed university in 2008-10. It is interesting to compare these figures to the U.S., where 40% of whites and 23% of blacks had completed university among 25-29 year-olds in 2012 (Aud et al. 2013). When we look at men and women separately (not shown), there is very little gender difference in any of the statistics in Table 1, a pattern found for most analyses of educational outcomes in South Africa (Anderson et al. 2001; Lam et al. 2011).

Looking at the last two rows of Table 1, African and coloured high school graduates are

[1] We pool three-year samples to increase sample size for the white and coloured groups.

much less likely than whites to receive any kind of post-secondary schooling. The proportion of high school graduates aged 25-29 that went on to post-secondary education was 19.1% for Africans and 41.1% for whites in 2002-4, rising to 20.8 for Africans and 44.2% for whites in 2008-10. The racial gap is even larger for university attendance, since the vast majority of Africans who go beyond high school receive some kind of diploma or certificate rather than a university degree. The proportion of African high school graduates going on to receive a university degree was only 5.8% in 2002-4, declining to 3.6% in 2008-10. The percentage of white high-school graduates receiving a university degree also declined over this period from 22.2% to 20.9% (this may reflect an increase in the proportion of young white university graduates who leave South Africa for some period of time rather than an actual decline in the proportion of whites going to university).

Research from the 1990s estimated high returns to secondary and post-secondary education in South Africa. Using 1993 data, Mwabu and Schultz (2000) found that the return for Africans to completing secondary school was nearly double the return for whites. Given that the percentage of South Africans receiving post-secondary education has not increased since 2000, it is not surprising that the returns to post-secondary education continue to be high. Table 2 gives estimates of the returns to education at different levels beginning at grade 10, based on the pooled 2000-2007 Labour Force Surveys, also collected by Statistics South Africa. The coefficients show the returns to completing a given level compared to the next lower level. Overall the returns are very high, even below grade 12. Africans with grade 10 earn 12% more than Africans with grade 9, controlling for a quadratic in age and dummies for male, year, and province. Africans with grade 12 earn 29% more than Africans with grade 11. As Mwabu and Schultz (2000) found using 1993 data, we find that returns to grade 12 and above are higher for Africans than for whites.

The diploma/certificate category in Table 2 includes a variety of post-secondary education that is outside traditional universities. This includes universities of technology, vocational colleges, and other training programs. The returns to these non-university programs appear to be very high, at least given these conventional OLS estimates. Africans with a non-university diploma have more than double the earnings of Africans with just grade 12. Africans with a university degree earn over 50% more than Africans with a diploma or certificate. As with secondary, the returns to post-secondary education are higher for Africans than for whites.

While the focus of this paper is on post-secondary enrollment rather than returns to post-secondary schooling, the very large returns shown in Table 2 provide an important backdrop for our analysis. It seems clear that the very low post-secondary enrollment rates for non-whites shown in Table 1 are not due to low returns to post-secondary investments for non-whites.

II. Institutional Background

All major universities in South Africa are public institutions that receive funding from the national government. A second tier of public "universities of technology" (formerly technikons) focus on technical and vocational training. The government has also increased funding in recent years for Further Education and Training (FET) colleges, which play a role similar to community colleges and vocational schools in the U.S. Private institutions are important in the non-university sector of higher education and include large, well-established institutions providing a wide range of certificate and diploma programs, as well as smaller programs offering specialized short courses.

Tuition in traditional degree-granting universities is high relative to income levels. In 2008 the average full cost of study (including registration fees, tuition fees, books, accommodation, and meals) at traditional universities was estimated at 43,000 rands per year (about US$10,750 using Purchasing Power Parity adjustments) (Department of Higher Education and Training 2010), while median household income (based on the 2008 National Income Dynamics Study) was 29,780 rands per year (US$7,445 PPP). Tuition in universities of technology was about 20% lower, still very high for even median income households. Although direct government funding to universities has decreased over time, state funding for the National Student Financial Aid Scheme (NSFAS) has increased. The NSFAS is supported by government funding and private donations, and aims to provide loans and scholarships (bursaries) to low-income students. About 15% of university students received NSFAS funding in 2008 (Department of Higher Education and Training 2010). The demand for funding, however, continues to far outweigh funds available. During the period of our study, NSFAS loans were not available for students studying at FET colleges.

The NSFAS is administered by university financial aid offices. Similar to U.S. systems, a means test and an estimate of the full cost of study are used to calculate an expected family contribution. NSFAS loans are offered to make up the difference, although a combination of

inadequate funding, imperfect administration, and incomplete knowledge among potential applicants mean that students do not necessarily receive the full difference. Students with incomes above a certain threshold are not eligible for funding, with the threshold varying across universities.

In addition to financing from NSFAS, financial assistance is available via institutional or private scholarships and through loans from commercial banks, the Eduloan program, and informal money-lenders. Eligibility requirements for commercial loans restrict this source of finance primarily to wealthy students, while informal lenders are known to charge excessive interest rates (Gurgand et al 2011). Eduloan, a private program financed by donors, targets middle income students who are not eligible for NSFAS but do not have the requirements necessary to apply for a commercial bank loan. Eduloan only provides short-term (10 to 22 month) loans and requires that the loan be paid off during the course of study. Eligibility for an Eduloan requires that the applicant, or individual taking out the loan on their behalf, be employed and that the installment amount does not exceed 25% of their monthly income (Gurgand et al. 2011).

Given the financial aid system, a key feature of South African higher education is that the cost of university attendance increases with family income, although the relationship may be fairly flat at low incomes. As pointed out by Belley and Lochner (2007), the fact that the effective price of university increases with family income implies that enrollment should decrease as a function of family income, holding academic ability and returns to higher education constant. As we will see, not surprisingly, university enrollment is in fact a strongly increasing function of family income in South Africa, just as it is in the U.S. and most other countries. Credit constraints are one way to explain this relationship. Although high-income families face a higher price of attending university, they face a lower cost of borrowing, partly because they can self-finance. As emphasized in previous literature, an alternative explanation of the positive relationship between income and enrollment is that prior academic achievement is positively correlated with family income as a result of the many educational advantages that higher income students have had over their lifetime. The Cape Area Panel Study gives us unusually rich data for a developing country setting with which to analyze these alternative explanations.

Another important feature of the institutional background is affirmative action in favor of

traditionally disadvantaged groups. Most South African universities have explicit discussion of preferential treatment of certain population categories in online admissions information and other sources. For example, the University of Cape Town lists four "redress categories" in its 2012 admissions policy: "black South African, Indian South African, coloured South African, and Chinese South African" (University of Cape Town 2012). "Equity targets" are set in each faculty. According to the document, "All faculties will aim to admit specified minimum numbers of eligible South African Black, Chinese, Coloured, and Indian students in accordance with these targets." The minimum acceptable scores for admission vary by group within a given program. Most programs reach their target admissions before reaching the minimum acceptable score, however, and we do not have information on the actual differences in cutoffs for admission.

In our regression results we find that Africans (blacks) are predicted to have higher university enrollment than whites once we control for high school test scores. As we discuss below, this may be evidence of affirmative action in admissions. Our data are not ideally suited to analyze the question, however, since we have data on enrollment rather than admission.

III. Data: The Cape Area Panel Study

The Cape Area Panel Study (CAPS) is a longitudinal survey that began in 2002 with a sample of 4,752 young people aged 14-22 in metropolitan Cape Town.[2] Cape Town has three predominant population groups – the distribution in the 2001 census was 48% coloured, 32% African/black, and 19% white. CAPS oversampled areas classified as predominantly African and white. Cape Town is the only major city in South Africa to have substantial numbers of white, coloured, and African residents, providing unique opportunities to study changes in inequality after the end of apartheid.

The Wave 1 young adult questionnaire, administered to up to three household members aged 14-22, covered a wide range of variables including schooling and work. It also included a literacy and numeracy evaluation. Wave 2 was collected in 2003 and 2004, Wave 3 in 2005, Wave 4 in 2006, and Wave 5 in 2009. Each wave collected information on education enrollment

[2] Details about CAPS, a collaborative project of the University of Cape Town and the University of Michigan, are available in Lam et al. (2012) and on the CAPS web site, www.caps.uct.ac.za. CAPS was collected under the auspices of Institutional Review Boards at the University of Michigan and the University of Cape Town.

and attainment since the previous interview. Respondents who reported having taken the grade 12 matriculation exam since the previous interview were asked to provide detailed information about the results of the exam.

The key outcome in our analysis is whether respondents were enrolled in post-secondary education within two years of completing grade 12 (requiring a passing grade on the matriculation exam). We use respondents who reported completing grade 12 between 2001 (reported in the 2002 Wave 1 interview) and 2007 (reported in the 2009 Wave 5 interview). We measure household income per capita, reported by an adult respondent in the CAPS household questionnaire, as close as possible to the year the respondents were in grade 12 (39% are measured in the year they pass grade 12, 25% are measured one prior, 19% are measured one year later, and 16% are measured two years prior).[3]

Table 3 provides information on sample attrition. Attrition is difficult to define precisely since our analysis conditions on an outcome – graduating from high school – that could occur up to five years after the baseline wave of the survey. Those who are lost from the sample but who never graduate from high school represent, in a sense, irrelevant attrition that does not create any attrition bias. Those who are lost from the sample and did eventually graduate from high school, however, represent true attrition, and non-random loss of these respondents could create some attrition bias. Table 3 presents one natural way of looking at attrition. We calculate the proportion of respondents who we follow for up to two years beyond the year at which they would have been expected to graduate from high school, assuming they progressed one grade per year. For those who were in grade 12 in the 2002 baseline survey, we see 88% of them two years later. Those who were in grade 7 in 2002 should have reached grade 12 in 2007, and thus need to be observed in Wave 5 of the survey. We successfully followed 68% of these respondents.

Column 3 of Table 3 shows the percentage of respondents in each baseline grade that we actually observe in grade 12. This conflates two issues – whether respondents made it to grade 12 and whether respondents stayed in the survey. Comparing Columns 2 and 3, we see that most students are not observed in grade 12 because they never got there, not because of attrition from

[3] We have enrollment data and matric score data for every year because CAPS collects data retrospectively for the period between waves. Household income is only captured in years with interviews, and thus is not always available for the year the student completes grade 12. We use income reports for the year after grade 12 only when the respondent is living with the same people as in grade 12.

the study. Among those in grade 10 in 2002, for example, we see 82% of them until at least 2006 (2 years beyond their expected graduation year of 2004), but we only see 55% of them ever enrolled in grade 12. Column 4 shows the percentage for which we have a grade 12 result, requiring that respondents were interviewed and provided matriculation exam results at least one year after grade 12. Overall we observe grade 12 outcomes for 71% of those observed in grade 12, with higher rates for those who were closer to grade 12 in 2002. Column 5 shows that the overall grade 12 pass rate among those with known results is 82%, with large differences across population groups. The pass rate for whites is 94%, compared to 74% for Africans. Column 6 shows that we successfully follow 92% of respondents for two years after passing grade 12, conditional on observing them pass.

If we define attrition using Column 2 of Table 3, overall attrition is 23%, with large variation by race and baseline grade. We lose 15% of the coloured sample, a group with strong historical ties to Cape Town, but we lose 44% of the white sample. As noted, these numbers arguably overstate attrition since they include the substantial percentage of respondents who never would have reached grade 12. Conditional on race and baseline grade, a regression shows no significant relationship between attrition and key baseline characteristics such as household income, parental education, or cumulative number of grades failed. One of our robustness checks is to exclude the respondents who were below grade 10 in 2002, the group with the highest attrition. The group that was in grades 10-12 in 2002 has an overall attrition rate of 15%. Although we lose some precision, our key results are not affected using this lower-attrition sample.

IV. Empirical Analysis

We begin our empirical analysis with an overview of individual and household characteristics we use in our regressions. Table 4 presents descriptive statistics for respondents that we observe completing grade 12 between 2001 and 2007 and that we are able to follow for the subsequent two years. Line 1 shows our first key outcome – whether the respondent was enrolled in university at any point during the two years after completing grade 12.[4] The percentage enrolling in university is 13% for Africans, 18% for coloureds, and 49% for whites.

[4] We use a two-year window to account for the fact that some students (mainly high-income students) take a "gap year" before beginning post-secondary education, while some lower-income students may take preparatory classes or work to earn money before beginning post-secondary education.

Looking at other types of postsecondary education in Lines 2-5, we see that 16% of Africans enroll in universities of technology, compared to 10% of whites. Another 19% of Africans and 27% of whites enroll in a wide range of other post-secondary institutions, including the public FET colleges and a variety of private institutions offering specific types of training.

Taking all post-secondary institutions together, and accounting for the fact that some respondents enrolled in more than one type of institution in the two years following grade 12, the proportion enrolled in any institution is 44% for Africans, 46% for coloureds, and 83% for whites. Line 5 shows that the proportion enrolling in some kind of post-secondary institution, conditional on not enrolling in university ranges from 35% for Africans to 66% for whites. We will use this as our second main outcome in the regressions below.

In CAPS we collect information on two tests of academic achievement. The first is a literacy and numeracy evaluation (LNE) that was administered to all youth respondents in Wave 1. The means and standard deviations of the combined literacy and numeracy score are reported in Line 6 of Table 4 (the score is standardized to zero mean and unit variance for the full sample of 14-22 year-old CAPS Wave 1 respondents). The LNE was a self-administered 45-question test that took about 20 minutes to complete. Respondents could take the test in English or Afrikaans. There was no version in Xhosa, the home language of most African respondents. The English language test was taken by 99% of African respondents, 43% of coloured respondents, and 64% of white respondents. In interpreting the results it should be kept in mind that most white and coloured students took the test in their first language, while Africans took it in a second language. It is also important to note, however, that English is the official language of instruction in African schools and is used for tests such as the grade 12 matriculation exam. The LNE scores are a measure of cumulative learning at the time of the 2002 interview, with scores reflecting a combination of many factors, including innate ability, home environment, and the quantity and quality of schooling to that point. Table 4 shows the large racial differences in performance on this test. The mean score for Africans was almost 1.5 standard deviations below the mean score for whites, even for this select group that passed grade 12. The standard deviation of African scores is double the standard deviation of white scores.

The score on the grade 12 matriculation exam features prominently in our analysis below. We calculate the score based on answers to questions about performance on the multiple subjects

tested separately in the exam, generating a score from 1 to 8.[5] We use an algorithm similar to that used by the University of Cape Town, which, like other universities, uses the matric exam results as the basis for admission. A score of 5 roughly corresponds to the cutoff for eligibility for admission to university. As seen in Line 7, both Africans and coloureds have a mean below 5, while whites have a mean of about 6. We will look at the distribution of these scores in more detail below.

Line 8 shows one important measure of progress through school, the number of grades failed as of the baseline survey in 2002. Grade repetition is very common in primary and secondary school, with Africans having failed an average of 0.6 grades at baseline. This compares to only 0.1 grades for whites. As Lam et al. (2011) show using CAPS data, there are high levels of grade repetition in black secondary schools, with grade repetition playing an important role in explaining racial gaps in ultimate educational achievement.

Given our interest in credit constraints, a key independent variable is household income measured when respondents were in high school (as close to grade 12 as possible). Lines 9 and 10 of Table 4 show the large differences in baseline household income per capita, as reported by an adult respondent in the household questionnaire. The mean for whites is about eight times greater than the mean for Africans. As shown below, there is almost no overlap in the income distributions for Africans and whites. Related to these differences, the mean school expenditures in 2002 (when respondents were still in secondary school) were 7.5 times greater for whites than for Africans.[6] Whites also pay more for post-secondary education, as shown in Line 12, a reflection of both the quality of the institutions attended and the provision of financial aid to poorer students. Evidence of the high cost of post-secondary education is that the mean amount paid by African students for post-secondary education was 4651 rands per year, which can be compared to mean per capita household income of 6432 rands per year. Median total annual household income for African households in this sample was 19,500 rands.

In addition to these enormous racial differences in baseline income and test scores, there are also large racial differences in parents' education. The mothers and fathers of African youth

[5] Students are tested in a minimum of six subjects (some required, with the remainder chosen from a large set of electives). Each subject is graded A to F. A score of 8 corresponds to a grade of A on every subject.

[6] In 2002 all schools charged school fees set by school governing bodies, in addition to costs of uniforms and other materials. Differences in fees translate into large differences in school quality, including the number of teachers (Fiske and Ladd 2004). Fees have recently been eliminated for the poorest schools (Department of Education, 2006).

have around four years less schooling than the parents of white youth, with father's schooling missing for 44% of Africans[7].

A. Income, previous achievement, and post-secondary enrollment

The top panel of Figure 1 presents lowess estimates of post-secondary enrollment within two years of passing grade 12 as a function of the log of household per capita income measured in high school. The figure shows enrollment in any kind of post-secondary education as well as enrollment in universities, with separate lines for each population group and for the combined population. As a reference for the lowess estimates, the bottom panel plots kernel densities of log household per capita income for each group, standardized so that the overall mean is zero. The kernel densities demonstrate the enormous racial differences in income. A striking feature is the very small range in which the African and white income distributions overlap, with the coloured distribution sitting in between.

In the ranges of income with significant densities, we see in the top panel that there is a strong positive relationship between high school household income and enrollment in post-secondary education. The slope of the gradient increases above mean log income, especially for university enrollment. One reason for the lower slope at low incomes, as we will see below, is the very low matriculation exam scores of youth from low-income households. While the line for whites in Figure 1 tends to be above the line for Africans, the distance between the two lines is relatively small compared to the large difference in enrollment shown in Table 4. This is especially true for university enrollment, where the lines for whites and Africans are almost indistinguishable in the small range in which the two income distributions overlap, even though there is a 36 percentage point difference in university enrollment in Table 4. This gives the first evidence that income plays an important role in explaining the racial differences in post-secondary enrollment. It is also striking that African enrollment is higher than coloured enrollment at almost every income level, whether looking at university enrollment or at all post-secondary education.

The gap between the line for all post-secondary institutions and the line for university gives the proportion enrolled in non-university programs of various kinds. Looking at this gap, we see that the proportion enrolled in non-university programs increases with income at low levels of

[7] Parental schooling comes from the household questionnaire when the parent is co-resident, and was collected from the young adult directly in the baseline questionnaire when the parent was not co-resident.

income, reaches a peak of about 30% around mean log income, then falls with income above the mean. Another interesting way to look at this is to look at enrollment in post-secondary programs conditional on not being enrolled in university. This is shown in Figure 2. Among those who do not enroll in university, there is a steep gradient in the probability of post-secondary enrollment as a function of grade 12 household income. The patterns are similar to those in Figure 1. Whites tend to have the highest enrollment, but there is little difference between white and African enrollment in the small range in which the income distributions overlap. Coloured enrollment is below enrollment for Africans and whites at all income levels.

One reason high school household income predicts subsequent post-secondary enrollment is because income is associated with better secondary school performance and higher matriculation exam scores. Figure 3 shows the relationship between matric score and grade 12 household income. While much of the large unadjusted racial gap in matric scores goes away when controlling for income, whites continue to have roughly one point higher matric scores than Africans and coloureds in the income ranges where the income distributions overlap.

We see in Figure 3 that matric scores rise rapidly with income above the mean, but are relatively flat below the mean. The flatness below the mean reflects several factors. First, our analysis uses respondents who passed their matriculation exam. While passing does not translate into an exact score, given multiple subject areas and a complex grading system, the lowest scores have been truncated from the distribution. It is also appears from other studies that school quality does not rise substantially with income below mean income. Branson et al. (2012) show that when schools are ranked by neighborhood income, grade repetition rates are equally high across the first three quintiles, even though household income and other characteristics vary substantially across the quintiles. Similarly, Spaull (2012) finds that grade 6 test scores do not increase across the first three school wealth quartiles, although they rise dramatically in the highest quartile.

Figure 4 shows the relationship between matric scores and post-secondary enrollment. We show the relationship for the full sample and for each income tercile. The bottom panel shows the distribution of matric scores for each tercile and the combined population. As seen in the bottom panel, matric scores differ dramatically by household income, with only a small portion of the lowest tercile having scores of 5 or higher, a good predictor of university eligibility. The top panel of Figure 4 shows, not surprisingly, that there is a very strong relationship between

matric scores and enrollment in post-secondary education. The gradient is steeper for university enrollment than for all post-secondary programs, especially above matric scores of 4. While the top income tercile has the highest enrollment, the gap between terciles is relatively small at a given matric score. Interestingly, the group with the lowest enrollment in any post-secondary program at high matric scores is the second tercile. This may be a reflection of the fact that middle income students are less likely to receive financial assistance than are the lowest income students.

Figure 4 makes it clear that the steep income gradient in post-secondary enrollment shown in Figure 1 results in large part from the correlation between grade 12 household income and matriculation exam scores. This appears to be especially true for university enrollment. The next section explores these issues in greater detail with regressions that allow us to include additional controls for individual and household characteristics.

B. Regressions for university enrollment

This section presents regressions in which our dependent variable indicates that the respondent was enrolled in university within two years after passing the grade 12 matriculation exam. One of our key empirical questions is whether baseline household income is associated with university enrollment, and whether the coefficient on income declines when we control for variables such as matric scores and parental education. Table 5 presents OLS estimates of the linear probability model using a variety of specifications.

Regression 1 includes only dummies for coloured and white (African is the excluded category), along with a dummy for female, dummies for the year in which the respondent completed secondary school, and terms for age and age squared in 2002. As expected given the sample means in Table 4, the coefficient on coloured is close to zero and statistically insignificant. The coefficient on white implies that whites have 31.2 percentage point higher probability of enrollment in university. Females have a slightly higher probability of university enrollment, but the coefficient is not statistically significant. The fact the females do at least as well as males in educational outcomes in South Africa is consistent with previous studies at the primary and secondary levels (e.g. Lam et al. 2011).

Regression 2 adds the log of high school household per capita income (normalized to zero mean) and its square, allowing us to capture the non-linearity apparent in Figure 1. The coefficient on the linear term is highly significant, implying that a 10% increase in income is

associated with a 1.1 percentage point increase in university enrollment. The quadratic term is also positive and highly significant, implying that the impact of income is higher at higher income levels. At the mean log income for whites (1.36), the derivative is almost twice as high as at the overall mean. A striking result in column 2 is that inclusion of household income causes the white coefficient to fall from 0.312 to 0.074, losing statistical significance. The coloured coefficient falls to -0.062, significantly different from zero at the 10% level.

In Regression 3 we add mother's education and father's education to the regression, an approach used in previous literature to measure long-term socioeconomic advantage or disadvantage. We estimate positive effects of both parents' schooling, controlling for grade 12 income. A one year increase in parental schooling is associated with a 2.1 percentage point increase in the probability of university enrollment for mother's schooling and a 3.5 percentage point increase for father's schooling. Including parental schooling causes the estimated impact of household income to fall substantially. The coefficient on the linear term falls by over half, to 0.05, while the coefficient on the squared term falls from 0.032 to 0.026. Including parental education also causes the coefficient on the white dummy to become roughly zero.

Parental education could represent a number of mechanisms affecting post-secondary enrollment. It may be a proxy for a household's permanent income, picking up the long-term effects of household resources on cumulative human capital. There may also be direct effects of parental education on children's learning that affects the probability of continuing to university. Whatever the mechanisms are that explain the impact of parental education, an important result for our purposes is that controlling for parental education causes the apparent effect of household income during the student's high-school years to fall substantially.

Regression 4 adds the matriculation exam score and the Wave 1 literacy and numeracy exam (LNE) score to the regression. For the matric score we use a linear spline with a change in slope at a matric score of 5, roughly the cutoff for admission into university. Matric scores are a strong predictor of post-secondary enrollment, but the effect is highly non-linear. The spline coefficients in Regression 4 imply that one additional point on the score raises the probability of enrollment in university by 5.0 percentage points in the 0-5 range, but raises the probability by 24.6 percentage points for scores above 5. The LNE score has an additional impact, with a one standard deviation increase in the score associated with a 6.9 percentage point higher probability of university enrollment. This may reflect that our LNE score captured some additional

cognitive ability beyond that measured in the matric score, or simply that students who did better on both exams are more skilled than students who for some reason did well on one exam and not on the other.

Including the matric and LNE scores reduces the coefficients on parental schooling, though both coefficients are still statistically significant. Importantly, the estimated impact of household income falls still further. The coefficient on the linear term is close to zero and statistically insignificant. The coefficient on the quadratic term falls to 0.11, roughly one-third its value in Regression 2. In other words, controlling for parental education and scholastic ability in high school has eliminated the apparent effect of income on university enrollment around mean income, although there is still an effect at higher levels of income.

Looking at the race dummies in Regression 4, the coefficient on the white dummy is now negative and statistically significant at the 1% level. Taken literally, the coefficient implies that when we control for baseline income, parental education, and matriculation exam scores, whites have a 21.8 percentage point *lower* probability of enrolling in university than Africans. In interpreting this result it is important to keep in mind the distributions of income and matric scores shown in Figures 1 and 4. There is very little overlap in the African and white distributions, making it difficult to estimate what whites would do if they had African characteristics. Our result is similar to the results found in Lam et al. (2011), where including controls for income and LNE scores causes a negative estimated effect of being white on progress through secondary school.

The result is also similar to results in the U.S., where controls for family background and test scores typically reverse the racial gap in educational outcomes. For example, Cameron and Heckman (2001) estimate a black-white gap of 0.11 in the probability of university enrollment, conditional on high school completion, with the gap reversing to -0.08 in a counterfactual in which blacks are assumed to have the same characteristics as whites. An interesting feature of our result is that we begin with a much larger white-African gap, 0.31, and also end up with a much larger gap in the other direction after controlling for characteristics, -0.22.

One possible interpretation of the negative coefficient on the white variable in Regression 4 is that it is evidence of affirmative action in university admissions in favor of African students. Many universities have explicit policies to promote the enrollment of historically disadvantaged South Africans. To explore this issue further, Regression 5 leaves out parental education and

household income, since these are presumably not taken into account in the university admissions process. When we control for matric scores and LNE scores, whites are 11.6 percentage points less likely to be enrolled in university than are Africans. This provides some evidence in favor of affirmative action in enrollment. It is important to recognize, though, that our data are not ideal for analyzing the role of affirmative action in university admissions as we have data on enrollment, not admission. It is possible that Africans are even more favored in admission than suggested by Regression 5, conditional on academic achievement, but that this is partially offset by obstacles to admissions such as lack of information about the application process.

The reversal of the white coefficient may also reflect the fact that African students who receive high matriculation exam scores are highly selected on characteristics such as motivation and drive that are unobserved in our data but may be observable to universities (for example, through letters of recommendation). Students with test scores above 5 represent the top 12% of African students, while 82% of white students have test scores above 5. Universities may believe that African students who are able to achieve high scores in the face of extreme disadvantage and lower quality schools are students who will also be able to achieve in university.

C. Predicting other post-secondary education

In Table 5 our measure of post-secondary enrollment is limited to university enrollment. As shown in Figures 1 and 2, the relationship between income and post-secondary enrollment appears to be different for universities of technology and other non-university programs such as short-term certification programs. Table 6 presents regressions in which the outcome is post-secondary enrollment conditional on not enrolling in university. One motivation for these regressions is that they might be viewed as describing the admission and enrollment decision process for those who are not eligible to be admitted into university. We present the same specifications shown in Table 5, beginning with simple race dummies and then adding controls for family background and matriculation exam performance.

Looking at Regression 1, whites are 22.7 percentage points more likely than Africans to enroll in some kind of post-secondary education, conditional on not enrolling in university. This gap completely disappears when we control for grade 12 household per capita income in Regression 2. There is a strong relationship between income and post-secondary enrollment.

The derivative is 0.12 at the mean, similar to the result in Table 5. We continue to estimate a positive coefficient on the quadratic term, but it is significant only at the 10% level. Looking at Regression 3, the apparent impact of income on non-university enrollment falls when we control for parental education, though not as much as it did in Table 5. As in Table 5, controlling for parental education drives the coefficient on white to almost zero, losing statistical significance.

Adding matric scores and LNE scores in Regression 4 has a smaller impact on the income coefficients in Table 6 than it did in Table 5. The derivative of enrollment with respect to log income at the mean is 0.065, statistically significant at the 1% level. This suggests that credit constraints may play a larger role in non-university enrollment than they do in university enrollment. Although financial aid programs exist for some public non-university programs, many non-university programs are private and do not offer financial assistance other than loan programs that may be out of reach for low-income students.

In Regression 4 we also see that matriculation exam scores have a smaller impact on non-university enrollment than they do on university enrollment. A one point increase in the matric score is associated with a 5.2 percentage point increase in the probability of enrollment in the 0-5 score range and a 14.5 percentage point increase in the 5-8 range.

As in Table 5, the coefficient on the white dummy in Table 6 becomes negative when we control for parental education, income, and high school academic achievement, although the -.134 coefficient is smaller than the -.218 coefficient in Table 5. Interesting, when we control only for matric scores and LNE scores in Regression 5, we cannot reject the hypothesis that the enrollment rates of Africans and whites are identical. This may reflect that there is less affirmative action in non-university programs, although as noted, our data are not ideal for identifying the role of affirmative action.

V. Counterfactual Simulations

Returning to the issue of the racial gap in post-secondary education, what do our results suggest about the role that credit constraints have on the racial gap in post-secondary enrollment in South Africa? How large would the racial gap in post-secondary education be if there were no issues in financing higher education? Suppose universities, for example, were free and provided free housing and meals, but no changes were made in the conditions that produce the large disparities in high school scholastic achievement. Or suppose all poor parents got rich just when

their children were finishing high school, too late to make up for earlier disadvantage but in time to pay for the best universities.

Carneiro and Heckman (2002) took the approach of assuming that young people from the richest quartile were financially unconstrained, calculating the gap between their enrollment and the gap of other income quartiles within bands of AFQT scores and controlling for family background. We take a modified version of this approach, predicting enrollment if we gave everyone the median white income, or, alternatively, the white income at the 90th percentile. We base the predictions on regression 4 in Tables 5 and 6, so that we are controlling for matriculation exam scores, LNE scores, and parental education. This would tell us the impact of credit constraints under the assumption that the only reason income affects enrollment in Regression 4 is financial constraints, given that we have controlled for family background and high school academic achievement. A different thought experiment imagines raising the high school academic achievement of all young people without changing household income or parental education. Specifically, we simulate giving everyone the median matriculation exam score of whites (a score of 6) and the median white score on the literacy and numeracy exam (a score of 1.38).

We create these counterfactuals for two samples. First, we use the full sample used in the regressions in Table 5. These counterfactuals are shown in columns 1-3 of Table 7. Second, we use only the sample that had matric scores of at least 4. These counterfactuals, shown in Columns 4-6, reflect the reality that no amount of income will increase enrollment for those without the minimum requirements for admission. Referring to Figure 4, we focus our analysis on the portion of the sample for which university enrollment appears to be an option, in the range of test scores where there is a gap in enrollment between high-income and low-income youth.

The first two rows of Table 7 show how much we have to increase household income in order to give everyone the 50th and 90th percentile of white incomes (The 50th and 90th percentiles of white log household per capita income are 1.38 and 2.16, respectively). Raising Africans to white median income requires that incomes be an average of 12.1 times higher. Raising African incomes to the white 90th percentile requires that incomes be an average of 27.8 times higher. This further illustrates the staggering income gap between whites and Africans. Raising Africans to a matric exam score of 6.0 would require roughly doubling scores on average, while raising Africans to the white median LNE score would require that scores

increase by an average of 4.6 times.

Line 6 of Table 7 shows that African enrollment in university would increase from 12.9% to 16.2% if all Africans had median white income, but all other characteristics, including parental education, matriculation exam scores, and LNE scores, remained constant. Coloured enrollment would increase from 19.9% to 22.5%. White enrollment would fall slightly, since half of whites would experience a decline in income and the biggest impact of income is at the top of the distribution. The overall African-white enrollment gap only falls slightly, from 43.1 percentage points to 39.5 percentage points. Even this probably overstates the role of financial constraints, since household income in Regression 4 is likely to still be reflecting long-run dimensions of advantage and disadvantage rather than simply the ability to pay for university.

We get a considerably larger effect if we give everyone the income at the 90th percentile for whites. This raises African enrollment to 20.6%, a 59% increase from the actual level. Coloured enrollment rises to 26.8%, a 19% increase. White enrollment also increases as households move up the steep portion of the income-university gradient. The absolute gap between whites and Africans continues to fall from 43.1 percentage points to 39.5 percentage points, but the relative gap falls from 4.3 times higher white enrollment at baseline to 2.9 times higher white enrollment when everyone has the white 90th percentile income.[8]

If we focus on the group that had matric scores of at least 4, shown in columns 4-6, the baseline probability of enrollment for Africans is 27.7%. This increases to 30.8% if everyone is given white median income, and 35.1% if they are given the white 90th percentile income. The levels of enrollment are higher in every case for this more select group (30% of Africans, 50% of coloureds, and 94% of whites have matric scores of at least 4), but the overall impact of these large increases in income is still quite modest relative to the baseline racial gap.[9]

What if we raise everyone's test scores instead of raising their incomes? Row 8 shows counterfactual in which we keep incomes (and everything else) at their original levels but increase everyone's matric scores and LNE scores to the median score for whites. This has a much larger impact on university enrollment than does raising incomes. African enrollment rises to 53.4%; coloured enrollment rises to 49.8%. White enrollment falls slightly, since half of

[8] Moving from everyone having white median income to everyone having white 90th percentile income is an additive shift in enrollment for everyone, so the absolute gap between groups does not change.

[9] If we re-estimate the regressions using only the sample with matric scores above 4, the predicted counterfactuals are very similar to those shown in Columns 4-6.

whites experience a score reduction, with white enrollment ending up below African enrollment. This is mainly because we continue to assume that Africans have a 21.8 percentage point higher intercept than whites as in Regression 4. In other words, we assume that whatever causes Africans to overachieve in enrollment relative to their test scores, income, and parental education, this continues to be the case in the counterfactual world in which their test scores rise to the level of whites. While this may seem unrealistic, it is important to note that we made the same assumption in the counterfactual for higher incomes, but Africans still ended up with far lower enrollment than whites, even when income was set to the white 90th percentile. The key point is that the coefficients in Regression 4 of Table 5 imply that raising African incomes to the white 90th percentile would raise their university enrollment by 7.7 percentage points, while raising African test scores to the white median would raise their enrollment by 41 percentage points. Clearly high school academic achievement is far more important in explaining the racial gap in university enrollment than is the ability to pay for university.

Lines 9-10 show the same counterfactuals using enrollment in any post-secondary institution, conditional on not being enrolled in university. In this case giving everyone the median white income has a larger effect than it did for university enrollment. We predict that Africans would move from 40.2% enrollment to 53.9% enrollment if they all had median white income. The white-African enrollment gap falls from 46 percentage points to 33 percentage points. Moving from the 50th to the 90th percentile increases African enrollment to 62.2%.

Raising matric and LNE scores to the white medians has a smaller impact on enrollment in non-university institutions than it has on university enrollment, a result of the smaller coefficients on test scores in Regression 4 of Table 6 compared to Table 5. It is still the case, however, that giving Africans the median test scores of whites has a bigger impact on the racial gap in enrollment than giving Africans even the 90th percentile of white income.

In sum, Table 7 implies the following estimates of the impact of credit constraints on post-secondary enrollment, using the counterfactual where we make everyone rich (giving them the white 90th percentile income) but do not change their parental education or high school academic achievement: If credit constraints were eliminated in this way, enrollment in university would increase by 7.7 percentage points (59%) for Africans, 6.9 percentage points (35%) for coloureds, and 4 percentage points (7%) for whites. Enrollment in post-secondary institutions among those who do not attend university would increase by 22 percentage points (55%) for Africans, 16

percentage points (39%) for coloureds, and 8 percentage points (10%) for whites. These are almost surely upper bounds on the role of credit constraints, however, since they assume that all of the apparent impact of income that remains when we control for test scores and parental education is due to credit constraints. Income could be picking up many other things, however. For example, the fact that we get the highest impact of income at the top of the distribution suggests that there is something about the very rich that gives them an advantage in university enrollment. While this could be the ability to pay for university, it could also be that these students go to elite high schools where everything about going to university is made simpler – counseling, help with applications, and peer support. Even controlling for academic achievement and parental education, these high-income students may be more likely to apply, get admitted, and enroll.

Even if we thought that lower fees or more generous financial aid could approximate our simulated impact of giving everyone the income of the 90th percentile white, the racial gap in post-secondary enrollment would remain extremely large. Whites would still be 2.9 times as likely as Africans and 2.2 times as likely as coloured youth to go to university. Whites would be 52% more likely than Africans and 62% more likely than coloured youth to enroll in non-university institutions, conditional on not attending university.

VI. Robustness of Results

Our key results are robust to a number of alternative sample restrictions and econometric specifications. As shown in Table 3, one concern about our sample is that we have considerable attrition among those who were in the lowest grades in our 2002 baseline sample. We have included everyone in our sample who ever completed grade 12 by 2007 in order to boost sample size. Those who were in Grade 7 in 2002, however, can only have completed grade 12 if they passed every grade on schedule. This will be a select group in primarily black schools, and might introduce some bias in our results. We have re-estimated our results using only the sample that was in at least Grade 10 in 2002. As shown in Table 3, we follow over 85% of this group for two years beyond their expected year of passing grade 12. The results with this lower-attrition sample are very similar to the results in Table 5 and 6 [10].

We have also estimated the regressions in Tables 5 and 6 in a number of different ways.

[10] These results are available from the authors on request.

Estimating probit regressions rather than OLS regressions produces very similar results. This might be considered important for our simulations, since our OLS regressions generate predicted values outside the 0-1 range for a non-trivial number of cases. Generating the counterfactuals using probit regressions produces very similar results[11].

We have also estimated the regressions separately by race. While the smaller sample sizes cause these estimates to be less precise than our estimates with the pooled sample, we cannot reject equality of coefficients between races for any of the variables shown in Tables 5 and 6, with the exception of the coefficient on father's education between the African and white regressions. This is not surprising, given the fairly similar slopes by race in Figures 1 and 2.

VII. Summary and Conclusions

Panel data from Cape Town indicate a strong positive relationship between the household income experienced by students when they were finishing secondary school and subsequent enrollment in post-secondary education. Given the large apparent impact of income on university enrollment and the enormous income differences between whites and Africans, income experienced during late high school can in and of itself statistically account for most of the 31 percentage point gap between Africans and whites in university enrollment.

Following the approach of previous U.S. literature, we show that controlling for high school academic achievement and parental education greatly reduces the apparent effect of high school income on university enrollment. The association between income and university enrollment does not entirely go away, however. Even with controls for parental education, matriculation exam scores, and our CAPS literacy and numeracy exam score, we continue to estimate an impact of income on university enrollment at high income levels – a 10% increase in income increases university enrollment by 0.3 percentage points, evaluated at the mean income for whites. Given this, we show that if Africans were given the incomes of the 90th percentile whites, holding parental education and high school achievement constant, they would experience a 65% increase in university enrollment. In spite of substantial efforts to provide financial support to highly qualified students from disadvantaged backgrounds, it appears that rich South Africans are still better able to access university, holding grade 12 matriculation exam scores constant. This suggests that it may be possible to do more to make university accessible to low-

[11] These results are available from the authors on request.

income students.

We find greater evidence of credit constraints in post-secondary programs outside of university. When we look at the enrollment in post-secondary programs of students who do not enroll in university, high school household income remains an important predictor of enrollment even after we control for parental education, matric exam scores, and LNE scores. A 10% increase in income is associated with a 0.65 percentage point increase in enrollment, evaluated at mean log income. In our counterfactual in which all Africans are given the median income of whites, without changing exam scores or parental education, enrollment in post-secondary education among those not attending university increases by 43%.

While these results suggest that it may be possible to do more to make post-secondary education accessible to low-income students, it is important to recognize that removing financial constraints alone would only slightly reduce the racial gap in post-secondary enrollment. Most of the gap is due to the enormous gaps in previous academic achievement. In our upper bound estimates in which we give everyone the income of the 90^{th} percentile white – implying an average 28-fold increase in African incomes – whites continue to have a 34 percentage point higher university enrollment rate. Even this likely overstates the gains that could be made from easing financial constraints alone, since it assumes that the estimated impact of income when we control for test scores and parental education is entirely due to short-run financial constraints.

It is important to point out that existing financial aid programs may be playing an important role in making higher education, especially university education, accessible to low-income students. We have no way to tell what would happen to enrollment if current financial aid programs were eliminated. So while it appears that additional increases in financial assistance would have only modest effects on enrollment, this does not mean that the current programs are not having a large impact on overall enrollment and the racial gap in enrollment.

Our results suggest that what is really needed to close the racial gap in post-secondary education in South Africa is to improve the learning outcomes for non-white South Africans at earlier stages in the educational system. The CAPS literacy and numeracy exam and the results of nationally standardized grade 12 matriculation exams indicate that by the end of high school there are already enormous racial gaps in academic achievement. It is this gap in high school academic achievement that plays the major role in explaining the racial gap in postsecondary education. Our results indicate that if Africans had the same matric scores and LNE scores as

whites, they would have higher university enrollment than whites, even without changing the racial gap in income. While there may be room for policies to reduce financial constraints on post-secondary education, our results suggest that little progress will be made in reducing the racial gap in post-secondary education until there is progress in reducing achievement gaps at earlier schooling levels.

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Table 1. Educational attainment of 25-29 year-olds, South Africa 2002-2010

	African			Coloured			White		
Educational attainment	2002-2004	2005-2007	2008-2010	2002-2004	2005-2007	2008-2010	2002-2004	2005-2007	2008-2010
Less than grade 9	25.7	22.8	19.6	31.0	21.1	18.5	1.7	3.5	2.2
Grade 9	8.3	9.0	9.0	11.1	9.9	10.6	1.8	1.5	1.4
Grade 10	11.6	11.9	13.1	10.9	12.2	14.0	12.2	10.4	7.1
Grade 11	15.7	17.2	18.1	7.4	12.0	11.0	3.2	3.9	1.6
Grade 12	31.3	31.5	31.8	33.8	37.1	36.7	47.8	47.3	48.9
Post-matric diploma/certificate	5.1	5.9	6.9	4.3	5.9	7.2	15.3	15.3	20.4
University degree	2.3	1.7	1.5	1.6	1.8	2.0	18.0	18.1	18.3
At least grade 12	38.7	39.1	40.2	39.7	44.8	45.9	81.2	80.7	87.6
Beyond grade 12	7.4	7.6	8.3	5.9	7.8	9.2	33.3	33.4	38.8
% of grade 12s going further	19.1	19.4	20.8	14.9	17.3	20.1	41.1	41.4	44.2
% of grade 12s with university degree	5.8	4.4	3.6	4.1	4.1	4.3	22.2	22.4	20.9
Observations	18606	19464	19077	2552	3192	2324	1547	1080	893

Data Source: South Africa General Household Survey 2002-20010
Note: University degrees include degrees from traditional universities, comprehensive universities, and universities of technology

Table 2. Returns to schooling, South Africa men and women aged 25-59

Education level	African	Coloured	White
Grade 10	0.121***	0.200***	0.0901*
	[0.013]	[0.022]	[0.052]
Grade 11	0.164***	0.231***	0.292***
	[0.012]	[0.023]	[0.033]
Grade 12	0.291***	0.297***	0.0666**
	[0.010]	[0.021]	[0.027]
Diploma/Certificat	0.897***	0.523***	0.231***
	[0.011]	[0.021]	[0.017]
University degree	0.515***	0.459***	0.370***
	[0.016]	[0.035]	[0.019]
Observations	112,758	24,309	17,258
R-squared	0.422	0.463	0.241

Data Source: South Africa Labour Force Survey 2000-2007.
Notes: Standard errors in brackets; significance levels: *=0.1, **=.05, ***=0.01; Regressions also include age, age squared, dummies for grades 1-9, male, year, and province dummies; coefficient is return relative to next lower level

Table 3. Sample Composition and Attrition

		Percent observed:				
	Wave 1 sample size	2 years after expected high school graduation	Ever enrolled in grade 12	With result for grade 12, given observed in grade 12	Passing grade 12, given result observed	2 years after grade 12, given observed passing grade 12
	(1)	(2)	(3)	(4)	(5)	(6)
Grade in 2002:						
Grade 12	390	88.2%	100.0%	78.5%	84.6%	95.2%
Grade 11	465	89.5%	77.8%	90.1%	83.7%	93.7%
Grade 10	572	81.6%	55.2%	79.7%	80.2%	91.6%
Grade 9	660	68.2%	45.2%	53.4%	79.9%	80.8%
Grade 8	399	66.4%	32.3%	20.2%	73.1%	100.0%
Grade 7	205	67.8%	8.3%	47.1%	87.5%	88.9%
Population Group:						
African/Black	1305	77.0%	50.4%	68.8%	74.4%	93.4%
Coloured	1025	85.3%	55.9%	74.7%	85.3%	95.8%
White	361	56.0%	77.8%	69.8%	94.4%	80.5%
Total	2691	77.3%	56.2%	71.2%	82.4%	91.9%

Data source: Cape Area Panel Study

Table 4. Mean and Standard Deviation for Key Variables

	Variable	African (N=493) Mean	SD	Coloured (N=520) Mean	SD	White (N=263) Mean	SD
	Proportion enrolled within 2 years of passing grade 12:						
1	University	0.13	0.33	0.18	0.39	0.49	0.50
2	University of Technology	0.16	0.37	0.11	0.31	0.10	0.30
3	Other tertiary	0.19	0.40	0.19	0.39	0.27	0.44
4	Any tertiary institution	0.44	0.50	0.46	0.50	0.83	0.38
5	Any tertiary, given not university	0.35	0.48	0.34	0.48	0.66	0.48
6	Standardized LNE score, 2002	-0.09	0.75	0.62	0.60	1.38	0.46
7	Matric Score (0-8)	3.53	1.18	4.23	1.21	5.97	1.34
8	Number of grades failed by 2002	0.61	0.77	0.31	0.62	0.10	0.38
9	Per capita household income in high school (rands/month)	536	611	1484	1692	4247	3731
10	Log per capita household income (zero mean)	-0.78	0.84	0.19	0.86	1.36	0.69
11	Educational expenditure in high school, 2002 (rands/year)	928	3782	1410	3378	6998	6536
12	Educational expenditure on post secondary (rands/year)	4651	5592	8002	6969	13212	10438
13	Mother's education (grades)	9.0	3.3	9.7	2.7	12.9	1.9
14	Father's education (grades)	8.5	3.8	9.9	3.1	13.2	2.1
15	Age in 2002	17.7	2.2	17.1	1.8	17.1	1.7
16	Female	0.58	0.49	0.56	0.50	0.50	0.50

Data source: Cape Area Panel Study

Notes: Some respondents were enrolled in more than one type of tertiary institution, so row 5 is smaller than the sum of rows 1-4. FET is Further Education and Training. LNE is CAPS Literacy and Numeracy Evaluation, standardized for the full 14-22 sample. Household income is measured as close as possible to grade 12 (see discussion in text). One rand equaled roughly 4 PPP US dollars in 2002.

Table 5. OLS regressions for probability of enrollment in university within two years of passing grade 12

Variable	Regression coefficients and standard errors				
	(1)	(2)	(3)	(4)	(5)
Coloured	0.002	-0.067**	-0.057**	-0.094***	-0.089***
	[0.028]	[0.030]	[0.028]	[0.026]	[0.026]
White	0.312***	0.074	-0.025	-0.218***	-0.116***
	[0.042]	[0.052]	[0.050]	[0.046]	[0.044]
Female	0.019	0.028	0.017	0.003	0.007
	[0.028]	[0.027]	[0.026]	[0.022]	[0.023]
Log hh per cap income in grade 12 (zero mean)		0.111***	0.050***	0.013	
		[0.014]	[0.015]	[0.013]	
Log hh per cap income squared		0.032***	0.026***	0.011**	
		[0.007]	[0.007]	[0.006]	
Mother's schooling			0.021***	0.013***	
			[0.005]	[0.005]	
Father's schooling			0.035***	0.023***	
			[0.005]	[0.005]	
Matric score spline (0-5)				0.050***	0.067***
				[0.013]	[0.014]
Matric score spline (5-8)				0.246***	0.276***
				[0.021]	[0.020]
Standardized LNE score				0.069***	0.094***
				[0.019]	[0.020]
Observations	1,276	1,276	1,276	1,276	1,276
R^2	0.138	0.200	0.272	0.433	0.395

Data source: Cape Area Panel Study

Robust standard errors in brackets. * significant at 10%; ** significant at 5%; *** significant at 1%. Marginal effects evaluated at sample means. All regressions also include age and age squared (in 2002) and dummy variables for year of graduation. Regressions that include parental schooling and test scores also include dummy variables for missing parental schooling and test scores.

Table 6. OLS regressions for probability of enrollment in post-secondary institution within two years of passing grade 12, conditional on not enrolling in university

Variable	Regression coefficients and standard errors				
	(1)	(2)	(3)	(4)	(5)
Coloured	-0.074**	-0.160***	-0.157***	-0.186***	-0.148***
	[0.036]	[0.041]	[0.039]	[0.044]	[0.041]
White	0.227***	0.008	-0.049	-0.134*	0.022
	[0.055]	[0.074]	[0.073]	[0.081]	[0.072]
Female	-0.003	0.015	0.017	0.020	0.010
	[0.035]	[0.034]	[0.034]	[0.033]	[0.033]
Log hh per cap income in grade 12 (zero mean)		0.120***	0.093***	0.065***	
		[0.022]	[0.023]	[0.023]	
Log hh per cap income squared		0.020*	0.017*	0.010	
		[0.010]	[0.010]	[0.011]	
Mother's schooling			0.035***	0.033***	
			[0.007]	[0.007]	
Father's schooling			-0.006	-0.008	
			[0.007]	[0.007]	
Matric score spline (0-5)				0.052**	0.062***
				[0.023]	[0.023]
Matric score spline (5-8)				0.145***	0.184***
				[0.056]	[0.055]
Standardized LNE total score				0.051*	0.077***
				[0.026]	[0.027]
Observations	1,013	1,013	1,013	1,013	1,013
R^2	0.093	0.130	0.159	0.192	0.149

Data source: Cape Area Panel Study

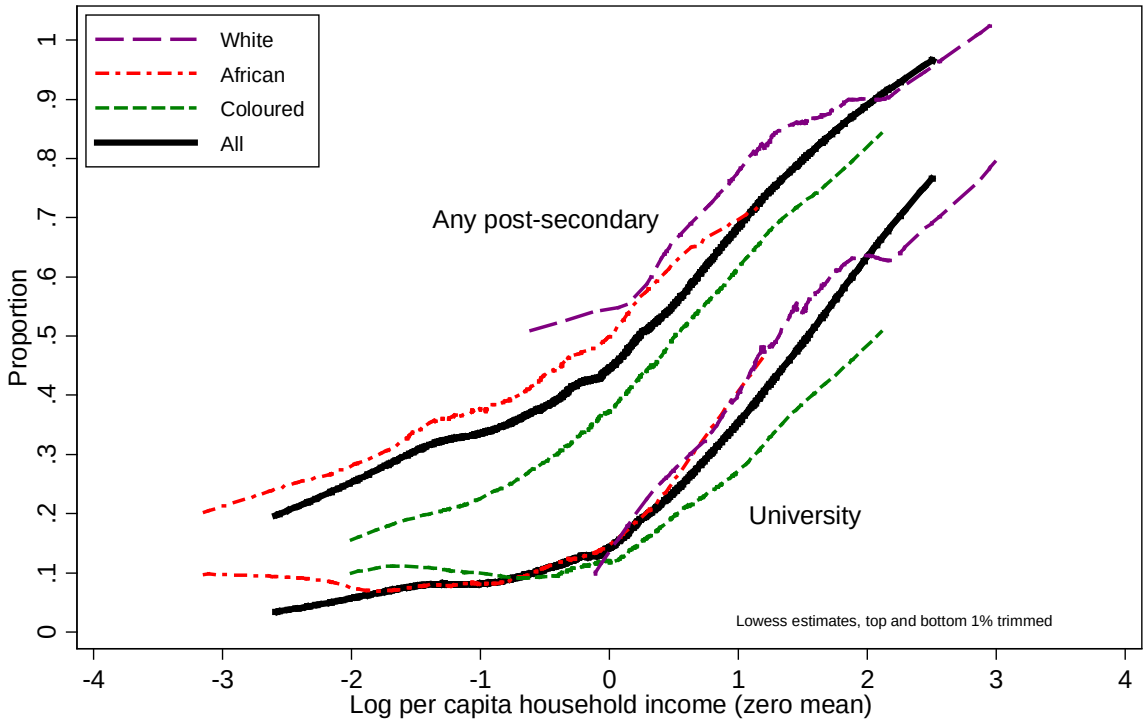
Robust standard errors in brackets. * significant at 10%; ** significant at 5%; *** significant at 1%. Marginal effects evaluated at sample means. All regressions also include age and age squared (in 2002) and dummy variables for year of graduation. Regressions that include parental schooling and test scores also include dummy variables for missing parental schooling and test scores.

Table 7. Simulated enrollment when incomes and test scores are set equal to values for whites
(Based on regression 4 in Tables 5 and 6)

	Full Sample			Matric Score >=4		
	African	Coloured	White	African	Coloured	White
	(1)	**(2)**	**(3)**	**(4)**	**(5)**	**(6)**
Average multiple required to give everyone:						
1. White median income	12.1	4.8	1.1	11.5	3.5	1.1
2. White 90th percentile income	27.8	11.0	2.6	26.4	8.1	2.5
3. Matric score of 6	1.9	1.5	1.1	1.3	1.2	1.0
4. White median LNE score	4.6	3.6	1.1	3.1	2.4	1.1
Predicted university enrollment:						
5. Actual income and scores	0.129	0.199	0.560	0.277	0.317	0.600
6. White median income	0.162	0.225	0.557	0.308	0.340	0.596
7. White 90th percentile income	0.206	0.268	0.600	0.351	0.383	0.639
8. White median test scores	0.534	0.498	0.525	0.561	0.528	0.532
Predicted enrollment, conditional on not enrolled in university:						
9. Actual income and scores	0.402	0.419	0.863	0.544	0.515	0.892
10. White median income	0.539	0.501	0.864	0.671	0.583	0.890
11. White 90th percentile income	0.622	0.583	0.947	0.754	0.666	0.973
12. White median test scores	0.692	0.626	0.847	0.734	0.653	0.853

Note:Predictions using actual income and test scores are the predicted values by race from regression 4. Predictions changing income use actual values for test scores and other variables. Predictions changing test scores use actual values for income and other variables.

Figure 1. Proportion enrolled in post-secondary education within 2 years of matric, by household income in grade 12



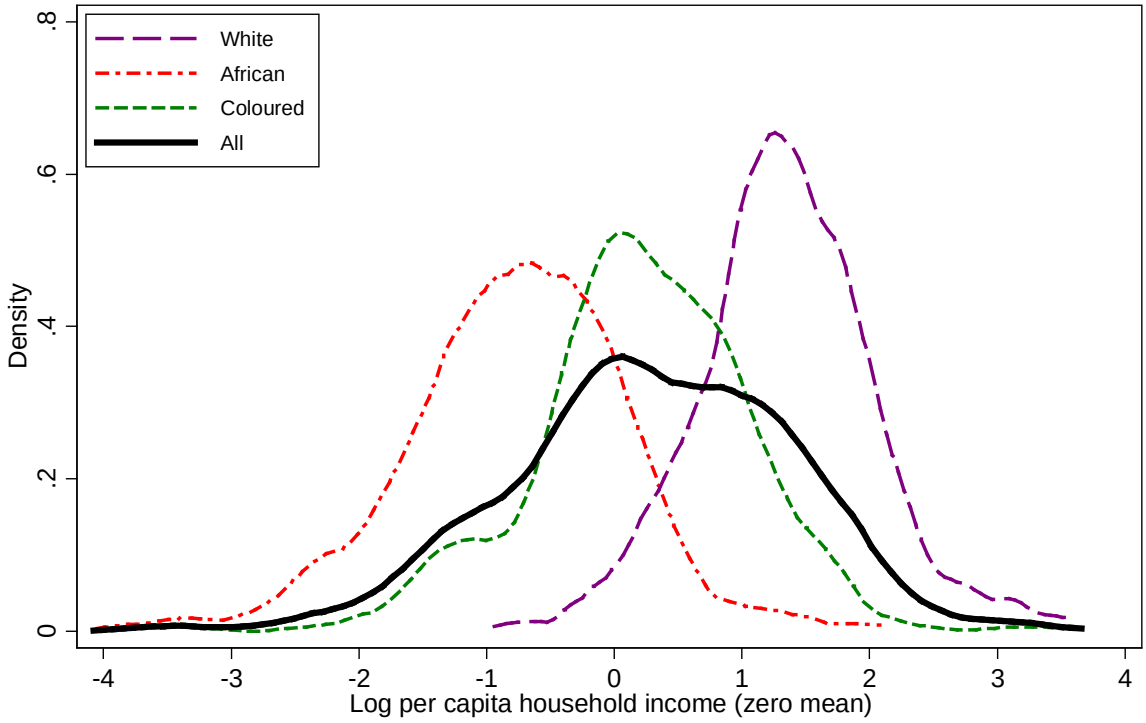


Figure 2. Proportion enrolled in post-secondary education by household income, conditional on not being enrolled in university

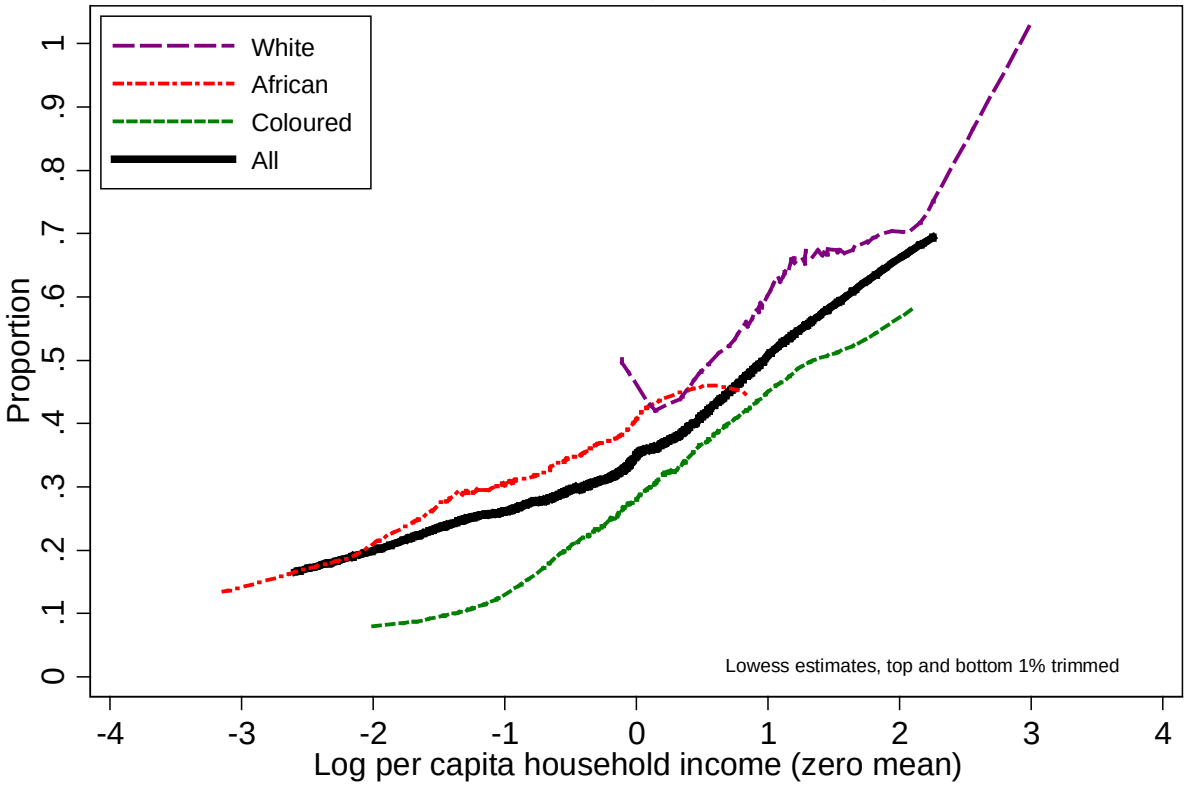
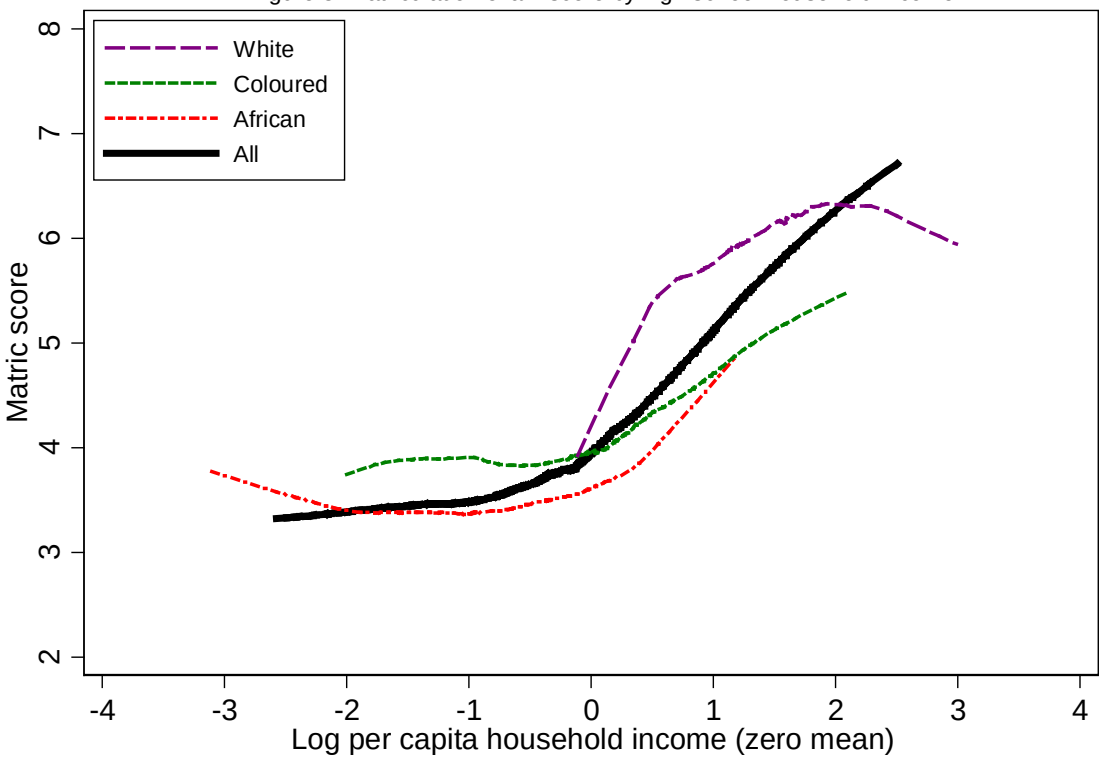


Figure 3. Matriculation exam score by high school household income



Lowess estimates, top and bottom 1% trimmed

Figure 4. Proportion enrolled in post-secondary education within 2 years of matric, by matriculation exam score