

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

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Abstract:

This paper analyzes the impact of baseline 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 post-secondary education. Our results indicate that baseline income and ability (measured in CAPS' literacy and numeracy evaluation) are strong predictors of post-secondary enrollment and statistically account for all of the black-white difference in enrollment. Controlling for parental schooling and baseline scholastic ability reduces the estimated impact of household income on enrollment, although the effect of income continues to be large. Two measures of short-term income variability do not have statistically significant effects on enrollment. While credit constraints may play a role, the evidence suggests that eliminating financing constraints would have only a modest impact on reducing the large racial gap in post-secondary enrollment.

Introduction

One of the key issues in economic research on post-secondary education in the United States is the extent to which credit constraints limit the ability of children from low-income families to attend college. While there is clear evidence that family income is strongly correlated with college attendance in the U.S., 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 analyzing these issues in the United States. Using the National Longitudinal Survey of Youth (NLSY) 1979, Carneiro and Heckman (2002) show that the association between family income and college attendance is greatly reduced by controlling for Armed Forces Qualification Test (AFQT) scores. They conclude that the apparent effect of income is due more to early life resource disadvantage than to credit constraints. Using the same NLSY 1979 data, Keane and Wolpin (2001) also conclude that credit constraints have a small impact on college attendance, partly because low-income students are more likely to work. Updating Carneiro and Heckman's analysis with the 1997 cohort of the NLSY, Belley and Lochner (2007) find an increased impact of family income after controlling for AFQT scores. They conclude that credit constraints have become more important in the U.S. over time. Further evidence of credit constraints in the U.S. is provided by Lovenheim (2008), who estimates 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 schooling 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 for most South Africans today are completion of secondary school and entry into post-secondary schooling. Second, the country has enormous income differences between rich and poor. These differences, which are strongly associated with race, are considerably larger than income differences observed in the U.S. Third, although most post-secondary education options are government funded, the cost of attending post-secondary institutions is high, especially for those in the lowest income groups. Issues of affordability may therefore play an important role in determining who is able to enroll. Finally, 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 in the design of the curriculum (Fiske and Ladd 2004). Although government funding levels were equalized across schools after 1994, there continue to be large racial differences in progress through school and ultimate educational attainment (Yamauchi 2005, Borat and Oosthuizen 2008, van der Berg 2007). As in the U.S. literature, disentangling short-run financial constraints from the long-run educational disadvantage associated with growing up poor is therefore very important in understanding inequality in post-secondary enrollment in South Africa.

We take advantage of longitudinal data from the Cape Area Panel Study (CAPS), a survey that began with about 4,800 14-22 year-olds in metropolitan Cape Town in 2002. In addition to detailed information on post-secondary education, household income, and other individual and household characteristics, CAPS administered a literacy and numeracy evaluation (LNE) to all respondents in Wave 1. Following the approach of Carneiro and Heckman (2002), these LNE scores allow us to at least partially control for baseline cognitive skills in analyzing the income of household resources on post-secondary enrollment.

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.

Empirical Patterns in Post-Secondary Education in South Africa

Table 1 uses the nationally representative Labour Force Survey (collected by Statistics South Africa) from 2000 and 2007 to analyze trends in educational attainment for 25-29 year-olds. One striking feature of the table is the large decline in the percentage with less than grade 9 education – from around 31% in 2000 to around 20% in 2007 – in both the African and coloured columns. This is a significant improvement in the bottom part of the schooling distribution. There has been much less improvement at the top of the distribution. The proportion of Africans with grade 12 or higher increased from 36% to 41%, but the proportion going beyond grade 12 increased only

slightly – from 7.4% to 7.5%. These compare to 80% of whites getting at least grade 12 and 32% of whites going beyond grade 12 in 2007. Only 1.7% of 25-29 year-old Africans had a university degree in 2007, roughly the same as 2000, compared to 16% of whites. 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, Case, and Lam. 2001; Lam, Ardington, and Leibbrandt 2008).

Looking at the last two rows of Table 1, African and coloured high school graduates are much less likely than whites to receive any kind of post-secondary schooling. The proportion of high school graduates aged 25-29 that had gone on to post-secondary education was 21% for Africans and 47% for whites in 2000, with declines for both groups between 2000 and 2007. The discrepancy 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 4.4% in 2000, declining to 4.2% in 2007. The percentage of white high-school graduates receiving a university degree also declined between 2000 and 2007 (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 using data from the 1990s estimated high returns to secondary and post-secondary education in South Africa. Mwabu and Schultz (2000) found using 1993 data that Africans had higher returns than whites, with African returns to secondary education being nearly double the return for whites. Given the fact 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 schooling by individual grade and post-secondary education level beginning at grade 10, based on the pooled 2000-2007

Labour Force Survey. The coefficients show the returns to completing a given level compared to the next lower level. Overall the returns are very high, even for grades less than high school completion. Africans with grade 10 earn 13% more than Africans with grade 9, controlling for a quadratic in age and a dummy for male. Africans with grade 12 (matric) earn 33% more than Africans with grade 11. Like 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-matric education that is outside universities. This includes universities of technology (technikons), vocational colleges, and other training programs. The returns to these non-university diplomas and certificates appear to be very high, at least given these conventional OLS estimates. Africans with a diploma have more than double the earnings of Africans with just matric. While the focus of this paper is on post-secondary enrollment rather than the 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.

Theoretical Background

As a theoretical foundation for our empirical analysis, we begin by assuming a standard human capital model of schooling decisions, and then discuss how it can illustrate key issues about education in South Africa. We assume that the decision of whether to enroll in a post-secondary institution is based on a comparison of the discounted present value of lifetime benefits with the costs. Consider a decision in period $t=0$ to attend a university that takes k years to complete, has tuition costs of C per year, and will raise subsequent earnings from Y_0 to Y_k . The difference between the present value of investing in university ($s=k$), subtracting off costs, and the present value of not attending university ($s=0$) is

$$PV(s = k) - PV(s = 0) = \left[\int_k^\infty Y_k e^{-rt} dt - \int_0^k C e^{-rt} dt \right] - \int_0^\infty Y_0 e^{-rt} dt = \frac{Y_k}{r} e^{-rk} - \frac{C}{r} [1 - e^{-rk}] - \frac{Y_0}{r} \quad (1)$$

where r is the rate of interest. Equation (1) will be positive, implying that college raises subsequent earnings by enough to cover both the direct monetary costs and foregone earnings, when the following condition holds:

$$\frac{\ln\left(\frac{Y_k + C}{Y_0 + C}\right)}{k} > r. \quad (2)$$

Equation (2) gives the condition under which any individual who could borrow money at the interest rate r should be willing to borrow to invest in k years of college. If we are considering one additional year of secondary school and C were zero, Equation (2) reduces to the familiar Mincer condition that an individual should continue in school for one more year if earnings increase by more than the rate of interest.

We are particularly interested in the extent to which financing constraints deter some individuals from attending college. One way to interpret credit constraints in the context of Equation (2) is an increase in the interest rate, implying that a higher expected increase in earnings is required to justify the investment. This means that a smaller percentage of the population will attend tertiary schooling and that those who do attend will be those with higher rates of return. In South Africa issues of financing schooling, especially at the tertiary level, are likely to be considerably more serious than in the U.S. Looking at reports in CAPS of fees paid by those attending post-secondary institutions in 2005, the mean fee paid by African students was around 8000 Rand per year (about US\$2000 using Purchasing Power Parity adjustments). This is more than double the median annual per capita family income for African respondents of around 3500 Rand. Median total annual household income for African households was 17,500 Rand. Most

African households have few financial assets and limited ability to borrow. The fees paid by African students would be even higher if they attended higher quality institutions. Our review of fees charged by major tertiary institutions in Cape Town indicates that annual fees are about 13,000 Rand at technical colleges and about 18,000 Rand at universities. While some financial aid is available, the cost of financing tertiary education is likely to be a serious constraint on most African students.

Individuals may have access to different sources of credit at different interest rates. As pointed out by Lovenheim (2008), they presumably access these resources sequentially, with self-financing from household wealth being the lowest cost resource that is accessed first. For black South Africans, access to family or household members who are receiving the state old-age pension may be an important source of funding. The pension pays about 11,000 Rand per year, close to the typical cost of post-secondary schooling. A 20-year-old living with a pension-eligible grandparent may be better able to finance post-secondary schooling than a 20-year-old without access to a pension recipient. Below we explore the fact that age eligibility for the pension creates a potentially exogenous source of variation in household and extended family income that may affect post-secondary schooling decisions.

As discussed above, an important point of debate in the literature on credit constraints in post-secondary schooling has been whether the positive relationship between family income and college attendance in the U.S. is due to credit constraints or cumulative long-term effects of family background on variables such as early childhood development, school quality, and home learning environment. Carneiro and Heckman's (2002) found in the 1979 NLSY that the impact of family income on college attendance is greatly reduced when they control for AFQT scores and parental education. In terms of the simple model outlined above, lifetime disadvantage associated with growing up in a poor household may lead to lower cognitive ability at the age at which post-

secondary schooling decisions are being made. Assuming that lower ability students have lower returns to post-secondary schooling, the left-hand side of Equation (2) will be reduced and investments in tertiary schooling will be less likely, even without any differences in the effective borrowing rate. An important advantage of CAPS is that the baseline literacy and numeracy evaluations make it possible to do the same kind of analysis done by Carneiro and Heckman and other papers in the U.S. literature. In addition to test scores and family income we are also able to control for parental education (even when parents are not co-resident) and a number of other important family background variables.

Data: The Cape Area Panel Study

Our empirical analysis uses the Cape Area Panel Study (CAPS), a longitudinal survey in metropolitan Cape Town.¹ Wave 1, collected in 2002, included 4,752 young people aged 14-22. 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 (LNE) which features prominently below. We use 2005, the timing of Wave 3, as the endpoint for the transitions we analyze. Data from Wave 4, collected in 2006, and Wave 5, collected in 2009, is used to fill in data for respondents who were not interviewed in Wave 3. Table 3 gives information on sample size and attrition. There were 4,752 respondents in

¹ Details about CAPS, a collaborative project of the University of Cape Town and the University of Michigan, are available in Lam et al. (2008) and on the CAPS web site, www.caps.uct.ac.za.

Wave 1, with relatively equal numbers of African and coloured respondents as planned in the sample design. The white sample is considerably smaller, a result in part of a lower response rate.² Looking at the sample with data for 2005, the overall attrition rate was 16%, with significant differences across population groups. The African attrition rate is 18%, with most attrition due to migration back to the rural Eastern Cape province that is the main sending region for Africans in Cape Town. The coloured population has its roots primarily in Cape Town, a factor contributing to its lower 10% attrition. The 32% attrition for whites includes both migration out of Cape Town (including out of South Africa) and a significant number of refusals.

The bottom panel of Table 3 shows attrition among those respondents who were enrolled in grade 10, 11, or 12 in 2002. Since most of our analysis will focus on respondents who completed secondary school in 2002, 2003, or 2004, this panel shows the group at risk of being in our target sample. Attrition is lower among this group than it is for the overall CAPS sample, with attrition for all population groups combined of 12%.

Empirical Analysis

We begin our empirical analysis with an overview of some of the individual and household characteristics we will use in our regressions. Table 4 presents descriptive statistics for respondents who completed grade 12 in 2002, 2003, or 2004. Line 1 shows the dependent variable in our first regressions, an indicator of whether the respondent was enrolled in any kind of post-secondary education in 2005. The percentage enrolling in post-secondary education varies enormously by race: 30% for Africans, 27% for coloureds, and 63% for whites. Looking at specific types of postsecondary education in Lines 2-4, we see that while 39% of whites are

² As in most South African household surveys, CAPS response rates were high in African and coloured areas and low in white areas. Household response rates were 89% in African areas, 83% in coloured areas, and 46% in white areas. Young adult response rates, conditional on participation of the household, were quite high, even in white areas. Given household participation, response rates for young adults were 93% in African areas, 88% in coloured areas, and 86% in white areas (Lam et al. 2008).

enrolled in university in 2005, only 9% of Africans and 10% of coloureds are enrolled in university. Enrollment in technical universities (technikons) is more similar across races – 10% for Africans, 8% for coloureds, and 6% for whites. About 10% of Africans and 8% of coloureds are enrolled in the diverse range of other post-secondary education. A higher proportion of whites – 17% – are enrolled in these other types of post-secondary institutions. Below we will estimate regressions using both the full set of post-secondary institutions and the more narrowly defined university and technical university group of institutions.

An important feature of CAPS is the 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 5 of Table 4 (the score is standardized to zero mean and unit variance for the full sample of 14-22 year-olds). 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 is important to keep in mind that most white and coloured students took the test in their first language, while Africans took the test in a second language. It must also be noted, however, that English is the official language of instruction in African schools and is used for many tests such as the grade 12 matriculation exam. We use the LNE scores as a measure of cumulative learning at the time of the 2002 interview. Performance on the test reflects 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 1.5 standard deviations below the mean score for whites. The distributions for this score are discussed in more detail below. The standard deviation of African scores is 60% larger than the standard

deviation of white scores. Table 4 also presents information on the number of grades failed, reported in line 6. African students have failed an average of 0.65 grades by 2002, compared to 0.37 for coloureds and 0.16 for whites. As Lam, Ardington, and Leibbrandt (2008) show using CAPS data in Lam, Ardington, and Leibbrandt (2008), 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 the impact of credit constraints, one of our key independent variables is household income. Lines 7 and 8 of Table 4 show the large differences in baseline household income per capita, as reported by an adult respondent in the Wave 1 household questionnaire. It is important to note that income is measured while the respondents are still in secondary school, making it an appropriate predictor of subsequent education outcomes. The mean for whites is about seven times greater than the mean for Africans. Related to these differences, the mean school expenditures in 2002 (when everyone in this group of respondents was still in secondary school) were about seven times greater for whites than for Africans. 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 have around four years less schooling than the parents of white youth, with father's schooling missing for 44% of Africans³.

We include in the regressions below two variables that are used as indicators of short-run changes in household financial resources. The first, shown in Line 12 of Table 4, is an indicator of household shocks. This is based on questions asked in Wave 3 in 2005. We define a negative shock as having occurred if the household experienced a death, job loss, loss of a grant or loss of support from outside the household, and if the household respondent reported that the shock had a

³ Parental schooling comes from the household questionnaire when the parent is co-resident, and is collected from the young adult directly when the parent is not co-resident.

moderate to severe financial impact on the household. Negative shocks were experienced by 13% of Africans, 12% of coloureds, and 6% of whites.

We also use an indicator of whether there was a pension-eligible person as part of the respondent's household in the year the respondent completed grade 12. This is based on the household roster in the 2002 baseline survey. The South Africa Old Age Pension is an important part of the social safety net in South Africa, providing significant resources to many households. Until recently women became eligible for this non-contributory pension at age 60 and men became eligible at 65. Although there is a means test, it is non-binding for most African elderly. As seen in Line 13 of Table 4, 17% of Africans and 23% of coloureds had a pension-eligible person in their household when they graduated from high school.

Income, ability, and post-secondary enrollment

The top panel of Figure 1 presents lowest estimates of post-secondary enrollment in 2005 as a function of the log of 2002 household per capita income. We continue to use the sample of respondents that completed high school in 2002, 2003, or 2004. As a reference for the lowest estimates the bottom panel plots kernel densities for each population group, standardized to the overall mean. 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 income and enrollment in post-secondary education. While the white line is everywhere above the African line, the distance between the two lines is relatively small compared to the large mean difference in enrollment shown in Table 4. In the very small range where the African and white income distributions overlap the white enrollment advantage is quite small. This gives the first evidence that income differences play an important role in explaining the racial differences in post-

secondary enrollment. It is also striking that African enrollment is higher than coloured enrollment across almost the entire income distribution.

Figure 2 presents similar graphs plotting post-secondary enrollment against the 2002 literacy and numeracy scores. The bottom panel shows the kernel density estimates of the distribution of scores for each population group. Note that there is only a small area of overlap between the test scores of Africans and whites, with a much higher variance among Africans. Once again we see that there is a strong positive relationship between the LNE score and the probability of being enrolled in post-secondary education in 2005. The gap between white enrollment and African enrollment at any given LNE score is fairly small. African enrollment is above coloured enrollment at every LNE score.

Probit regressions for post-secondary enrollment

This section presents probit regressions in which our dependent variable indicates that the respondent was enrolled in some kind of post-secondary education in 2005, using the sample of respondents who completed grade 12 between 2002 and 2004. One of our key empirical questions is whether baseline household income is associated with post-secondary enrollment, and whether the coefficient on income declines when we control for variables such as baseline test scores and parental education. Table 5 presents the marginal effects implied by the coefficients from probit regressions, with the marginal effects evaluated at the sample means.

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 slightly negative but statistically insignificant. The coefficient on white implies that whites have 29 percentage point higher probability of enrollment in post-secondary schooling.

Regression 2 adds the log of baseline household per capita income and its square to the regression. The coefficient on the linear term implies that a 10% increase in income implies a 1.5 percentage point higher probability of post-secondary enrollment, evaluated at the mean. The coefficient on income squared is positive but is not statistically significant at conventional levels. The striking result in column 2 is that inclusion of household income in the regression causes the white coefficient to fall from 0.36 to -0.05, losing statistical significance. The coloured coefficient falls to -0.23, significantly different from zero at the 0.01 level. Taken literally, the regression implies that if Africans and whites had the same baseline income, they would have the same probability of enrolling in post-secondary schooling.

Regression 3 adds the standardized Literacy and Numeracy Evaluation score to the regression. LNE scores are a strong predictor of post-secondary enrollment. A one standard deviation increase in the LNE score is associated with a 16 percentage point increase in the probability of enrolling in a post-secondary institution. One of the major issues analyzed by Carneiro and Heckman (2002) using the 1979 NLSY was the extent to which the impact of family income declined when measures of baseline ability were included in the regression. While the marginal effect of income falls between Regression 2 and Regression 3, the decline is relatively small. A 10% increase in household income implies a 1.5 percentage point increase in enrollment in Regression 3, compared to a 1.3 percentage point increase in Regression 2.

Looking at the race dummies in Regression 3, the coefficient on the white dummy is now negative and statistically significant at the 5% level. The marginal effect implies that when we control for baseline income and test scores, whites have an 18 percentage point *lower* probability of enrolling in post-secondary education than Africans. In interpreting this result it is important to keep in mind the distributions of income and LNE scores shown in Figures 1 and 2. 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 (and vice versa). Our result is very similar to the results found in Lam, Ardington, and Leibbrandt (2008), where including controls for income and LNE scores causes a negative estimated effect of being white on progress through secondary school. While the result must be interpreted with caution, it suggests that baseline income and scholastic ability play a major role in explaining racial differences in post-secondary enrollment.

In Regression 4 we add mother's schooling and father's schooling to the regression, another approach used by Carneiro and Heckman to pick up long-term disadvantage. We estimate positive effects of both parents' schooling, although the effect of father's schooling is only significant at the 10% level. A one year increase on mother's schooling is associated with a 4 percentage point increase in the probability of post-secondary enrollment. Including parental schooling in the regression reduces the estimated impact of household income by over 40%, from 0.13 to 0.08, although the coefficient on income continues to be statistically significant at the 1% level. Including parental education also reduces the estimated impact of the LNE score by about 20%. Parental education could represent a number of mechanisms affecting post-secondary enrollment. It may be a good 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 is not picked up by the LNE score and affects post-secondary enrollment. Whatever the mechanisms are that explain the impact of parental education, an important result for our purposes is that controlling for parental education reduces the apparent effect of household income on post-secondary enrollment by over 40%.

Estimating the impact of changes in income

The regressions discussed above suggest that about 40% of the apparent effect of household income on the probability of post-secondary enrollment may be picking up the effect of parental education and the cumulative learning that higher-income students had when they were finishing

secondary school. This is important from a policy perspective, since policies such as reduced university tuition or financial aid programs will not be able to compensate for the cumulative educational disadvantages associated with growing up in a poor household.

In order to see whether credit constraints are affecting the ability of young people and their families to finance post-secondary education, we would ideally like to observe short-term changes in income and estimate the impact of those changes on post-secondary enrollment. Column 5 of Table 5 uses two measures of short-term income changes available in CAPS. The first is the household shock variable discussed above, indicating whether the household experienced a negative financial shock between 2002 and 2005. This is intended to measure unexpected declines in income, and should therefore have a negative impact on enrollment if credit constraints are binding. As seen in Column 5, the coefficient on the household shock variable has the predicted negative sign. It is very imprecisely estimated, however, and we cannot reject that it is zero at conventional significance levels. We also use an indicator of whether there was a pension-eligible household member in the year the respondent graduated from high school. Since the pension is an expected change in income this may have a different effect than an unexpected household shock. The estimated effect of a pensioner is positive, as predicted, but the coefficient is imprecisely estimated and is statistically insignificant. One interpretation of the insignificant coefficients on the household shock and presence of a pensioner is that there really is no effect of short-term income changes on enrollment. This could mean that credit constraints are not a serious factor in enrollment. Unfortunately we cannot rule out the possibility that the shock and pension variables are too imperfect as measures of short-term income variation to detect the actual effect.

Using a narrower measure of enrollment

In Table 5 our measure of enrollment includes any kind of post-secondary institution, including things like short-term certification programs. It may be more appropriate to focus on

university and technical university (technikon) enrollment, since these represent the more formal degree programs that have the highest labor market returns. Table 6 repeats the regressions in Table 5 using this narrower measure of post-secondary enrollment. While the main results from Table 5 can still be seen in Table 6, a few differences are worth noting. The coefficient on white in Table 6 is smaller than the coefficient in Table 5. Whites have an 18.6 percentage advantage in enrollment in university or technikon, compared to the 29 percentage point advantage they had in all post-secondary enrollment in Table 5. This is consistent with the evidence from the sample means in Table 4 that the diverse set of “other” post-secondary institutions are actually used more by whites than by Africans. Related to this point, the impact of income on enrollment is smaller with the narrow measure in Table 6 than it was with the broad measure in Table 5. This could indicate that the post-secondary institutions outside of universities and technikons are relatively expensive, with income playing a larger role in things like private vocational colleges than it does in universities or technikons. The impact of the LNE score is larger with the narrow measure of enrollment. This result should be expected if literacy and numeracy skills are more important for admission to universities and technikons than they are for other post-secondary institutions.

Summary and Conclusions

Our panel data from Cape Town indicate that there is a strong positive relationship between the household income experienced by students when they were finishing secondary school and their later enrollment in post-secondary education. Given the large impact of income on post-secondary enrollment and the enormous income differences between whites and Africans, income alone can statistically account for the entire 29 percentage point racial gap in post-secondary enrollment. This apparent effect of household income on subsequent post-secondary enrollment may pick up a wide variety of effects. On the one hand it may indicate that credit constraints limit the ability of low-income students to continue their studies after secondary school. On the other

hand it may simply pick up the cumulative effects of income experienced since birth on human capital acquired by the end of secondary school.

Following the approach of Carneiro and Heckman (2002), we show that controlling for baseline scores on the CAPS Literacy and Numeracy Evaluation reduces the apparent effect of baseline income on enrollment. The reduction is relatively small, however. The estimated effect of a 10% increase in household income falls from a 1.5 percentage increase in enrollment to a 1.3 percentage point increase in enrollment. The effect of the LNE score is substantial, with a one standard deviation increase in the 2002 LNE score associated with a 16 percentage point increase in the probability of post-secondary enrollment in 2005. Controlling for parental education reduces the coefficient on income by almost 50%, suggesting that roughly half of the apparent effect of income on enrollment is due to the long-term effects of permanent income and the benefits of having better educated parents.

We use two indicators of short-term income variation in order to look more directly for effects of credit constraints on post-secondary enrollment. The first measure, an indicator that the household experienced a negative financial shock between 2002 and 2005, has the predicted negative coefficient but is not statistically significant. The second measure, an indicator of whether a household member received South Africa's generous old-age pension at the time the respondent graduated from high school, has the predicted positive coefficient but is also statistically insignificant. Taken literally, these results suggest that short-term income fluctuations do not have a significant impact on post-secondary enrollment. This may mean that credit constraints and the ability to finance education do not play an important role in explaining post-secondary enrollment rates in South Africa. We do not want to push this interpretation too hard, however, since these are somewhat imperfect measures of short-term income changes.

We are more confident with what our results imply about long-term socio-economic

disadvantage and racial differences in post-secondary enrollment. Our regressions imply that the very large racial gap in post-secondary enrollment can be entirely explained by a combination of household income and cognitive ability measured late in high school. When we control for parental education, baseline income, and baseline test scores, our regressions imply that Africans would actually have 23 percentage point *higher* post-secondary enrollment than whites if Africans had the same characteristics as whites. While this may overstate the extent to which we can explain the racial gap in enrollment, the results clearly suggest that a policy of lowering tuition or increasing financial aid would have only a very modest impact on the racial gap in post-secondary enrollment. Given the large racial gap in cognitive ability at the end of high school, financing constraints appear to be a relatively small component of the racial gap in post-secondary enrollment.

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**Table 1. Highest level of education for 25-29 year-olds,
South Africa Labour Force Survey 2000 and 2007**

Highest grade completed	African		Coloured		White	
	2000	2007	2000	2007	2000	2007
Less than Grade 9	31.1	20.2	32.9	20.7	2.6	2.1
Grade 9	8.0	9.0	10.4	8.9	1.6	3.6
Grade 10	10.3	11.6	12.6	14.9	10.1	9.1
Grade 11	14.8	18.4	8.4	10.7	8.5	5.7
Grade 12	28.4	33.3	27.8	38.1	41.1	47.1
Post-matric diploma/certificate	5.8	5.8	4.0	5.3	19.1	16.3
University degree	1.6	1.7	3.9	1.4	17.1	16.2
At least Grade 12	35.8	40.8	35.7	44.8	77.2	79.6
Beyond Grade 12	7.4	7.5	7.9	6.8	36.1	32.5
% of Grade 12 going further	20.6	18.5	22.2	15.1	46.8	40.8
% of Grade 12 completing university	4.4	4.2	10.9	3.2	22.1	20.3
Observations	9,176	6,655	1,240	1,045	673	372

Table 2. Returns to schooling, men and women aged 25-59, South Africa Labour Force Survey 2000-2007

Grade level	African	Coloured	White
Grade 10	0.126 [0.013]***	0.271 [0.027]***	0.236 [0.065]***
Grade 11	0.216 [0.012]***	0.349 [0.029]***	0.403 [0.042]***
Grade 12	0.331 [0.011]***	0.408 [0.027]***	0.089 [0.035]**
Diploma/certificate	1.088 [0.012]***	0.898 [0.033]***	0.277 [0.023]***
University degree	0.552 [0.020]***	0.563 [0.054]***	0.419 [0.028]***
Observations	158,653	30,980	14,237
R-squared	0.33	0.39	0.18

Standard errors in brackets; **significant at 5%; ***significant at 1%; also in regression: age, age squared, dummies for grades 1-9, male, year, and province; coefficient is return relative to next lower level

Table 3. Young adult response rates in the Cape Area Panel Study

Population Group	Wave 1 sample size	Sample observed in 2005	Response rate to 2005
(1)	(2)	(3)	(4)
Full sample			
<i>African</i>	2151	1773	82.4%
<i>Coloured</i>	2005	1803	89.9%
<i>White</i>	596	405	68.0%
<i>Total</i>	4752	3981	83.8%
Respondents in grade 10, 11, or 12 in 2002			
<i>African</i>	669	574	85.8%
<i>Coloured</i>	583	552	94.7%
<i>White</i>	218	170	78.0%
<i>Total</i>	1470	1296	88.2%

These observations may be taken from Wave 3, 4, or 5. Column 4 is the ratio of Column 3 to Column 2.

**Table 4. Descriptive statistics, CAPS Waves 1-5,
CAPS respondents who completed grade 12 in 2002, 2003, or 2004**

Variable	African (N=232)		Coloured (N=312)		White (N=145)	
	Mean	Std. Dev.	Mean	Std. Dev.	Mean	Std. Dev.
1 Any post-secondary enrollment in 2005	0.296	0.457	0.271	0.445	0.626	0.486
2 University enrollment in 2005	0.091	0.289	0.106	0.309	0.392	0.490
3 Technikon enrollment in 2005	0.106	0.308	0.078	0.268	0.062	0.241
4 Other post-secondary enrollment in 2005	0.099	0.299	0.087	0.283	0.172	0.379
5 Standardized LNE total score	-0.029	0.720	0.619	0.584	1.343	0.444
6 Number of grades failed by 2002	0.651	0.811	0.371	0.658	0.163	0.486
7 Household per cap income	586	810	1383	1222	3918	2658
8 Log hh per cap income (zero mean)	-0.459	1.000	0.619	0.807	1.747	0.722
9 Annual school expenses in 2002 (rands)	1,277	4,770	1,434	3,776	7,168	6,979
10 Mother's education (grades completed)	8.95	3.24	9.63	2.78	12.98	1.86
11 Father's education (grades completed)	8.70	3.88	9.93	3.01	13.15	2.11
12 Household shock between 2002 and 2005	0.131	0.338	0.120	0.325	0.058	0.234
13 Household pensioner at year of graduation	0.166	0.373	0.228	0.420	0.068	0.252
14 Graduated 2002	0.330	0.471	0.357	0.480	0.391	0.490
15 Graduated 2003	0.394	0.490	0.364	0.482	0.358	0.481
16 Graduated 2004	0.293	0.456	0.281	0.450	0.267	0.444
17 Age in 2002	17.92	1.73	17.04	1.31	17.07	1.22
18 Female	0.535	0.500	0.579	0.495	0.514	0.502
19 Household shock missing	0.158	0.365	0.078	0.269	0.178	0.384
20 Mother's education missing	0.123	0.329	0.028	0.164	0.033	0.179
21 Father's education missing	0.441	0.498	0.223	0.417	0.056	0.230

Table 5. Marginal effects from probit regressions for probability of enrollment in any post-secondary education for CAPS respondents who completed grade 12 between 2002 and 2004

Variable	(1)	(2)	(3)	(4)	(5)
Coloured	-0.0747 [0.0512]	-0.230*** [0.0616]	-0.301*** [0.0653]	-0.270*** [0.0641]	-0.277*** [0.0636]
White	0.293*** [0.0639]	-0.0448 [0.0892]	-0.182** [0.0884]	-0.219*** [0.0791]	-0.224*** [0.0771]
Age in 2002	-0.339 [0.280]	-0.227 [0.290]	-0.202 [0.292]	-0.0874 [0.302]	-0.0643 [0.300]
Age squared	0.00775 [0.00775]	0.00482 [0.00806]	0.00447 [0.00811]	0.00138 [0.00841]	0.000733 [0.00836]
Female	0.0602 [0.0455]	0.0550 [0.0454]	0.0836* [0.0457]	0.0882* [0.0461]	0.0875* [0.0460]
Log hh per cap income (zero mean)		0.148*** [0.0302]	0.131*** [0.0307]	0.0774** [0.0325]	0.0798** [0.0324]
Log hh per cap income squared		0.0105 [0.0154]	0.00546 [0.0150]	0.00263 [0.0149]	0.00320 [0.0151]
Standardized LNE total score			0.160*** [0.0409]	0.128*** [0.0411]	0.128*** [0.0409]
Mother's schooling				0.0398*** [0.0113]	0.0394*** [0.0114]
Father's schooling				0.0188* [0.0109]	0.0187* [0.0108]
Household shock between 2002 and 2005					-0.0348 [0.0694]
Household pensioner at year of graduation					0.0426 [0.0604]
Observations	662	661	658	658	658

Robust standard errors in brackets. * significant at 10%; ** significant at 5%; *** significant at 1%. Marginal effects evaluated at sample means. All regressions also include dummy variables for year of graduation. Regressions that include parental schooling and household shock variables also include dummy variables for missing parental schooling and household shock information.

Table 6. Marginal effects from probit regressions for probability of enrollment in university or technikon for CAPS respondents who completed grade 12 between 2002 and 2004

Variable	(1)	(2)	(3)	(4)	(5)
Coloured	-0.0762 [0.0477]	-0.197*** [0.0551]	-0.270*** [0.0579]	-0.232*** [0.0553]	-0.231*** [0.0554]
White	0.186*** [0.0619]	-0.0947 [0.0645]	-0.209*** [0.0536]	-0.220*** [0.0471]	-0.219*** [0.0469]
Age in 2002	0.0259 [0.275]	0.112 [0.271]	0.0765 [0.256]	0.158 [0.254]	0.167 [0.251]
Age squared	-0.00301 [0.00775]	-0.00526 [0.00764]	-0.00377 [0.00715]	-0.00591 [0.00710]	-0.00614 [0.00702]
Female	0.0510 [0.0396]	0.0462 [0.0386]	0.0736* [0.0387]	0.0779** [0.0374]	0.0801** [0.0374]
Log hh per cap income (zero mean)		0.120*** [0.0285]	0.0983*** [0.0286]	0.0485* [0.0282]	0.0510* [0.0279]
Log hh per cap income squared		0.00882 [0.0133]	0.00470 [0.0128]	-0.00228 [0.0122]	-0.00272 [0.0123]
Standardized LNE total score			0.168*** [0.0366]	0.134*** [0.0360]	0.135*** [0.0358]
Mother's schooling				0.0211** [0.00910]	0.0214** [0.00911]
Father's schooling				0.0327*** [0.00923]	0.0323*** [0.00912]
Household shock between 2002 and 2005					0.0313 [0.0595]
Household pensioner at year of graduation					0.0216 [0.0497]
Observations	662	661	658	658	658

Robust standard errors in brackets. * significant at 10%; ** significant at 5%; *** significant at 1%. Marginal effects evaluated at sample means. All regressions also include dummy variables for year of graduation. Regressions that include parental schooling and household shock variables also include dummy variables for missing parental schooling and household shock information.

Figure 1. Proportion enrolled in post-secondary education in 2005, by income

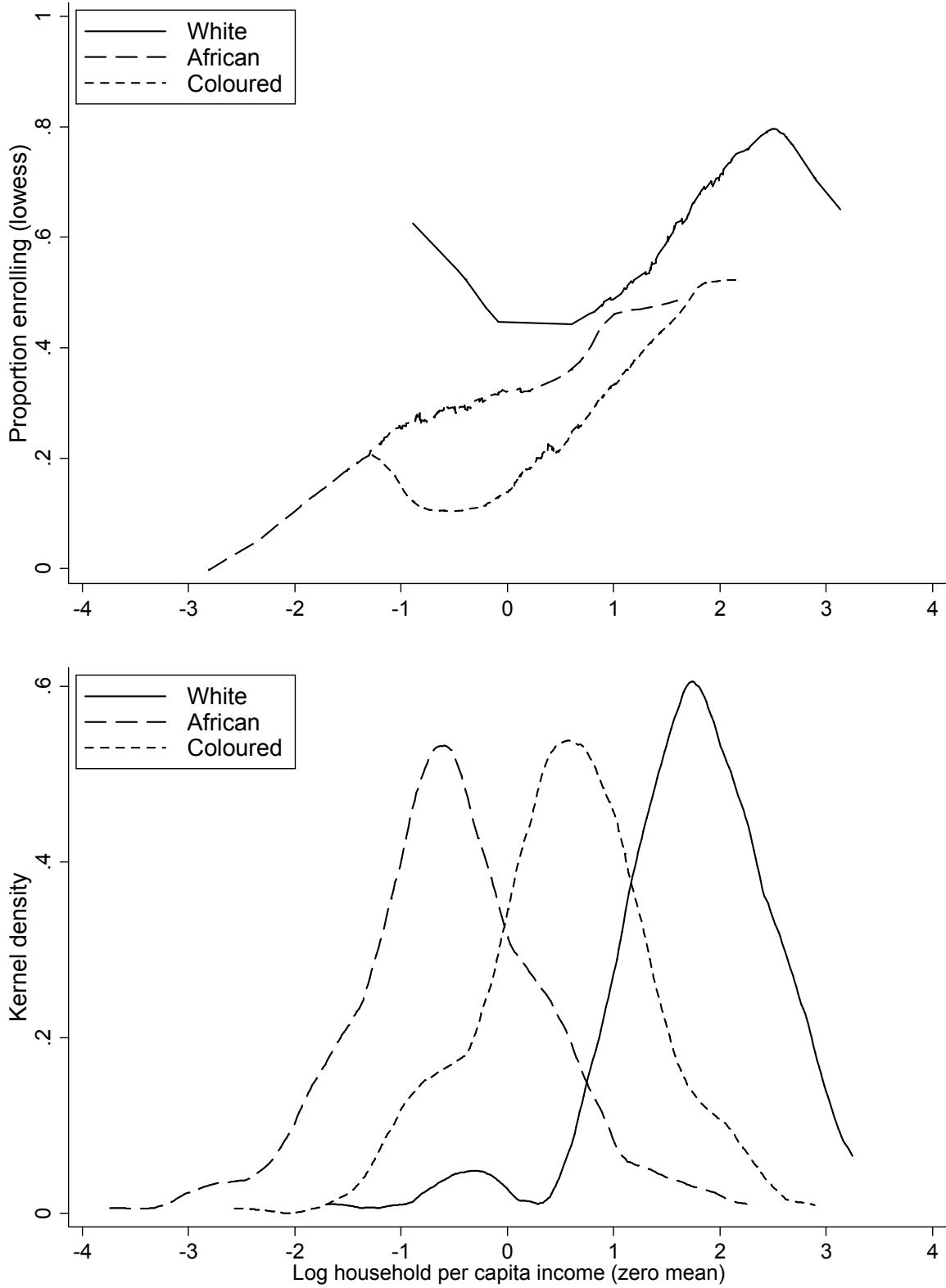


Figure 2. Proportion enrolled in post-secondary education in 2005, by LNE score

