ECONOMIC GROWTH CENTER

YALE UNIVERSITY

P.O. Box 208269
27 Hillhouse Avenue
New Haven, CT 06520-8269

CENTER DISCUSSION PAPER NO. 785

WAGE PREMIA FOR EDUCATION AND LOCATION, BY GENDER AND RACE IN SOUTH AFRICA

T. Paul Schultz
Yale University

Germano Mwabu
University of Nairobi

February 1998

Note: Center Discussion Papers are preliminary materials circulated to stimulate discussions and critical comments. This is a revised version of the paper originally written in May 1995.

Financial support was provided by the Rockefeller Foundation.

We have benefited from the comments of Martha Ainsworth, Harold Alderman, Michael Lipton, Peter Moll, Duncan Thomas and participants of the ESPE meetings in Lisbon, June 2, 1995 and the Northeast Development Conference at Harvard. We appreciate the computing assistance of Paul McGuire.

ABSTRACT

Despite the lower quality of education provided Africans compared with whites in South Africa, the percentage wage gains associated with additional years of primary, secondary, and higher education are substantially larger for Africans than for whites in 1993, and they increase for both race groups at higher levels of education. The lower quantity (or political quotas) of education received by Africans than whites is a simple explanation for the wage structure documented in this paper. The other two racial groups, colored (mixed races) and Indians, occupy intermediate positions between whites and Africans in terms of both the quantity of education received and wage returns to those levels of education. As barriers to employment by race are dismantled in South Africa, wage differences between races are likely to diminish, while wage differences within race groups may well widen. Quantitative expansion of educational opportunities for nonwhites at the secondary and higher education levels seems to be overdue.

Keywords: Wage Structure, Educational Quotas, Returns to Education, South Africa

JEL Classification: J31, I21, H52

1. INTRODUCTION

Wage differences are analyzed in this paper across groups of South African workers, distinguished by race, sex, and education. The past political system of South Africa erected institutional barriers to employment, property rights, civil rights, and regional mobility, according to an individual's race or ethnic origin. This comprehensive system of discrimination under apartheid against black Africans, and to a lesser degree against colored (mixed race) and Indian racial groups, undoubtedly affected wages and employment of all South Africans. The personal distribution of wage and employment opportunities is described in this paper based on a representative household sample of 43,974 individuals interviewed in the latter half of 1993.

Discrimination against Africans in South Africa intensified after 1948 and the ratio of white to black African wage rates increased until about 1970. In the subsequent decade, the ratio of white to black wages diminished in mining and manufacturing where unions developed, but unemployment mounted in the 1980s. Wage trends among the employed in the formal sector may consequently not characterize trends in the welfare of the entire population (Thompson, 1990). As the national economy stagnated, the regime attempted to send jobless black Africans to so-called "homeland territories" where they were not always counted in official South African statistics. Without detailed representative data from this period on the socioeconomic status of the entire South African population, there is much uncertainty on what conditions are like today, and how public policy priorities should be determined in the future.

We examine data from the 1993 Project for Statistics on Living Standards and Development (PSLSD) collected by the Southern African Labour and Development Research

Unit (SALDRU) in the School of Economics at the University of Cape Town in collaboration with the World Bank. Rescinding international trade and investment restrictions on South Africa in 1994, and introducing new policies by the democratically elected government are expected to have profound long-run effects on the structure of wages and employment. But the 1993 wage patterns analyzed here represent a starting point to understand the distributional implications and productive consequences of human resource development policies of the previous regime.

The focus of this paper is on wage premia associated with educational investments and on how wages vary by region, within race and sex subsamples. Subsequent research will consider the determinants of the allocation of time of individuals among union and non union wage employment, other labor market work, unemployment, and home production. Moreover, future analysis should be extended to include additional forms of human capital than education, in particular health and nutritional human capital (Schultz, 1994). The remainder of the paper is organized as follows. Section 2 introduces the empirical model and describes the data; patterns of wages by race and sex are described, with and without controls for worker characteristics in section 3; private returns to education are summarized by level and refined by type of higher education in section 4; wage differences between race groups are decomposed into group differences in education, experience, and location in section 5; section 6 summarizes and concludes. Additional tables are available in Appendixes that report sample statistics, alternative wage models that incorporate corrections for sample selection bias.

2. MODEL AND DATA

The standard human capital earnings framework is used to estimate the wage premia associated with the education and location of workers (Mincer, 1974; Rosen, 1977; Griliches, 1977; Willis, 1986; Schultz, 1994). Observed wage differences between workers with different investments in their training and location are jointly determined by the aggregate labor market's demand for labor across regions and skills, and the individual's supply of time and resources to produce and optimally locate these skills. It is assumed that the derived demand for labor is determined outside of the model, and consequently the variation in wages associated with human capital investments signals the premia that motivate individuals to sacrifice current resources to acquire and supply to the labor market these reproducible skills.[1]

The difference in the logarithm of the wage of workers that is associated with one more year of schooling is interpreted as an approximation for the private rate of return that a worker earns on the opportunity cost of his time out of the wage labor market to attend school for an additional year (Mincer, 1974; Rosen, 1977). This approximation is based on many working assumptions, perhaps the most important of which is that credit markets provide all people with funds to invest in their human capital at the same interest rate. Errors in measuring human capital and omitted variables from the wage function, such as genetic endowment, which may be correlated with human capital, can also bias return estimates (Welch, 1975; Griliches, 1977). Lacking information in our South African survey on family background that might be associated with the cost of credit or a family's propensity to invest in human capital, or on individual ability, or errors in the measurement of education, or panel data over time, we cannot consider how changes in these working assumptions concerning these factors might influence our estimates of wage returns.

We can, however, consider another potential source of bias in estimating wage returns to

---

[1] The hourly wage is defined to include the value of bonuses, subsidies and income in kind.

education and location. Sample selection bias (Heckman, 1979) may arise if estimates of returns are based only on wage earners who may not be a representative sample of all persons receiving different amounts of education. Sample selection bias of the wage function could be a serious problem, because only between 15 and 47 percent of the individuals age 16 to 65 in our eight race/sex subsamples are wage earners (Table A-1). To correct for sample selection bias, we must observe variables that both influence the probability that an individual participates in the wage labor force (estimated as a Probit model) and are not theoretically a determinant of the individual's (logarithm of the) market wage. These exclusion restrictions from the wage function help to identify the sample selection correction, in addition to the functional form assumed (normality) for the error in the (Probit) selection model.

We have specified twelve variables from the survey that describe the household's assets and nonearned income, which are expected to reduce the likelihood that an individual would be a wage earner, by increasing the probability that the individual works as self employed, or in a family enterprise, or does not participate at all in the labor force. These variables are defined and their means reported in Appendix Table A-1, section c, and include the following: Market value of nonfarm assets, rental income from assets, nonfarm asset income, value of self-employment equipment, use-rights to cropping land, cropping land that can be sold, proportion of land irrigated, use-rights to stock farming land, market value of land that can be sold, other interest income.[2] We would prefer to model the migration process from rural to urban areas by the Africans, and jointly analyze this decision with their choice of working in a wage job, self employment, or other activities, as Vijverberg (1993) was able to

---

[2] In predicting the decision to be a wage earner, these variables are more significant among rural groups with some access to land. Some variables are equal to zero for all members of some (urban) subsamples, and consequently these variables are excluded from the estimations for these subsamples (Appendix Table A-4). Under the old regime land could not generally be owned by nonwhites, and consequently many Africans in the rural labor force had only community or tribal rights to work the land, but could not sell those rights. Hence, it is difficult to ascertain the asset value of land worked by many African agricultural workers, since that land had no market. The use-right to the land by workers may have been a factor discouraging them from migrating to urban wage markets. See Table A-2 for the questionnaire sources of these and other variables used in this study.

in Cote d'Ivoire. Our single wage earner selection equation is therefore a substantial simplification, imposed on us mostly by the data.[3]

Region is represented by old state boundaries, to capture the extent to which the old four provinces and ten homeland boundaries created labor market barriers to mobility and hence restricted wage opportunities for some groups. A dummy variable is also included that equals one if a sample cluster is reported to be rural (versus metropolitan or urban in the metro file). Local community transportation infrastructure may further affect opportunities to commute to wage employment in neighboring areas. A dummy variable is therefore included that is one if there exists tarred (paved) roads in the sample cluster. In about five percent of the survey clusters there is no response to this question, and we set the tarred road variable to zero and defined a dummy variable that is one only for these clusters without information on this local transportation infrastructure variable.

The effect of years of educational attainment on the log wage is approximated by a three-level spline, which distinguishes between the returns to seven years at the primary level (standards 1-5, plus substandards A and B), five years at the secondary level (standards 6-10), and four years at the higher education level. The first specification of the wage function includes only these three slope coefficients for the linear segments of the wage function in years of education, plus a rural residence variable. The second specification includes the transportation infrastructure and 14 region variables, where Transvaal province is omitted and hence represented by the overall constant. The third specification includes, in addition, five indicators of the type of diplomas received that attempt to control for the

---

[3] The survey provides few ideal variables on which to determine the selection of even the wage earner status, except assets, some of which are potentially a reflection themselves of occupational choice. We therefore repeated the selection correction based on other sets of wage identifiers (Table A-4) and found decreased significance of the vector of identifiers and decreased statistical significance of already marginal coefficient on Lambda. Most of the land use rights and financial asset variables were associated with the individual being less likely to work for wages, as expected, but there were anomalous positive coefficients on irrigated land, salable crop land, and self-employment equipment for the Africans. Our identifiers for the colored and Indian samples, who are concentrated in urban areas, have even less predictive power than for the whites.

market value of different types of specialized education. However, the coefficients on the diploma type dummy variables may also reflect errors we introduced by having to attribute to each diploma a certain number of years of full-time study as described in Table A-2 (Cf. Moll, 1992a, 1995).[4]

The data are from a national survey of about 9,000 households in South Africa, drawn from 360 sample clusters, comprising 43,974 individuals. The field work for the survey was undertaken over the period August to December 1993 by a team from the World Bank and South African universities and research organizations. The survey is an adaptation of the Living Standards Measurement Surveys of the World Bank (see Ainsworth and Munoz, 1986 and Grosh and Glewwe, 1995 for a description of these surveys). The data collection instruments and the two-stage sampling methods used are described in SALDRU (1994).[5]

The sample we examine is restricted to the population of labor force age--16 to 65 years--for a total of 25,569 individuals who reported information on educational attainment, nonhuman wealth, and other relevant labor market variables. As already noted, the sample is broken down in Table 1 by gender and by four main ethnic groups, namely, African, Colored, Indian, and White. Some of the

---

[4] We assumed it required two years of full-time study to obtain a teaching or nursing certificate, 3.5 years on average for a technikon diploma, 4 years for university degree, and 1 year for the diploma from a junior/vocational college. This final credential/qualification category is probably the most diverse, and is mostly obtained by Africans, presumably before they were admitted in greater numbers to universities. If individuals reported going to a university but not receiving a degree, they are attributed two years of higher education. To illustrate how the estimates are to be interpreted, assume an African woman received a nursing certificate, and the coefficient for African women on this dummy variable is .79 and that for years of higher education is .70, then the expected value of her log wage is 2.19=(.79 + 2.0*.70) larger than for an African woman who only completed secondary school. By contrast, if the African woman had completed teacher training her wage would only be .36=(-1.04 +2.0*.70) larger for the same two years of training (coefficients are from Table 4 later in the paper).

[5] A random sample of population clusters was first drawn from a country-wide listing of census districts, from which in turn, the required number of households was picked. Three hundred and sixty clusters were chosen, with an expectation of picking 25 households per cluster, so as to yield a total of 9,000 households, and some 45,000 individuals. The actual number of households interviewed was 8,848, while the number of individuals enumerated was 43,974, or approximately a one-in-one-thousand self-weighting clustered sample of the South African population, which is estimated to have then been 40.1 million (SALDRU, 1994).

Table 1

Characteristics of the South African Survey Population Age 16-65
and of the Wage Earner Samples, by Race and Sex

Sample Size Variable Mean	African		Colored		Indian		White	
	Men	Women	Men	Women	Men	Women	Men	Women
All Persons Age 16-65:	9325	10473	958	1075	363	411	1447	1517
Years of Education	7.00	6.92	8.62	8.17	10.6	9.34	11.8	10.4
Proportion of Population with Some Education:								
Primary	.874	.843	.959	.944	.961	.927	.955	.916
Secondary	.493	.506	.720	.644	.909	.796	.928	.840
Higher	.023	.026	.031	.026	.140	.061	.346	.197
Post-School Experience in Years	19.5	20.2	18.5	19.5	18.3	18.8	18.9	20.6
Rural Resident	.676	.676	.072	.063	.008	.005	.092	.090
Homelands	.640	.687	.001	.001	.006	.005	.001	.001
Proportion in Labor Force	.521	.318	.724	.558	.786	.392	.850	.622
Proportion of Labor Force Unemployed	.145	.175	.123	.180	.072	.090	.028	.039
Proportion of Wage Earners	.254	.146	.365	.290	.468	.260	.451	.347
Wage Earner Sample:	2364	1533	350	312	170	107	653	527
Years of Education	6.81	7.55	8.54	8.51	11.0	10.7	12.2	11.2
Post-Schooling Experience in Years	24.7	24.2	21.2	20.3	18.9	16.2	19.2	18.6
Rural Resident	.561	.472	.103	.099	.018	.009	.066	.068
Homelands	.335	.419	0	0	.012	.009	0	.002
Log Hourly Wage Rate	1.56	1.18	1.97	1.62	2.55	2.10	3.33	2.76
Hourly Wage in Rand ($1.00 = 4.64 Rand; Financial Rate 5/93)	4.76	3.25	7.17	5.05	12.81	8.17	27.9	15.80

Source: Authors calculation from the survey file for all persons age 16-65 reporting their sex, education, residential region and wage earner identifier variables (See Tables A-1 and A-2).

race/gender sub-samples are somewhat small to permit precise parameter estimates of the wage function, but aggregation tests nonetheless reject the homogeneity of wage and participation parameters across these race and gender subsamples.

More than three-fourths of the South African population of labor force age (16-65) is black African, with 8 percent colored, 3 percent Indians, and 14 percent white. Rates of participation in the labor force range from 52 percent for Africans, to 72 and 79 percent for coloreds and Indians, respectively, and 85 percent for whites. Forty-five percent of the white men are wage earners whereas only 25 percent of the African men are. In addition to the low levels of labor force participation among African men, suggesting poor employment prospects, conventional measures of unemployment are also relatively high among African and colored groups. The unemployment rate is 14.5 percent for African men and 12.3 percent for colored men, but substantially lower at 2.8 percent for white men.

Women exhibit roughly similar patterns, with labor force participation rates of 62 percent for whites, 39 for Indians, 56 for coloreds, and 32 percent for Africans. Of these labor force participants, 18 percent of the black and colored women are unemployed, 9 percent of Indians, and 4 percent of whites. The percentage share of women who are wage earners is correspondingly lower than for men, 15 for Africans, 29 for coloreds, 21 for Indians, and 35 for whites.

The educational attainment of Africans of labor force age is about seven years for both men and women, where a person completing primary schooling is assigned seven years of schooling (form 2). Among colored persons education is 8.6 for men and 8.2 years for women. Indian men have 10.6 and women 9.3 years of education. Among whites, educational attainment averages 11.8 years for men and 10.4 for women. In general, the educational attainment of wage earners is higher than for other workers in the labor force. Wage earners tend to be somewhat younger and consequently less experienced (as approximated here) than other workers among all whites, all Indians, and colored women. But among all Africans and colored men, wage earners are older than other workers, because

of the high levels of unemployment and self employment among the young black and colored workers.

The population of South Africa is relatively urbanized, but not uniformly across racial groups. Among coloreds 93-94 percent are urban, virtually all Indian workers live in urban areas, and 91 percent of the whites do. However, among Africans only 32 percent of the men and women reside in urban areas, with nearly two-thirds residing in the ten homeland territories (SALDRU, 1994). The likelihood of being a wage earner is higher in urban areas than in rural or homeland areas, explaining in part the lower proportion of Africans working in wage employment compared with the other three race groups.

3. WAGE PATTERNS BY RACE AND SEX

Among wage earners, African men receive a wage that is 17 percent of what white men receive, whereas African women earn 21 percent of what white women earn (See Table 1, based on exponentiating the mean log wages in bottom row). Colored men and women earn 26 and 32 percent as much as do white men and women, whereas Indian men and women earn 46 and 52 percent as much as do their white counterparts. Race differences in wages decrease but remain substantial even after controlling for years of education, type of advanced diploma, years of postschooling experience, region of residence and a sample cluster's transportation infrastructure. The wage differences described in the balance of this section are based on the OLS regressions fully reported in Tables 2, 3, and 4.

4. ESTIMATES OF EDUCATIONAL RETURNS

The ordinary least squares estimates of the wage equation are reported fully in Table 2 whereas the two-stage Heckman (1979) estimates of the wage equation corrected for sample selection are shown in Appendix Table A-3, where the standard errors are corrected to take account of Lambda being predicted. The vector of wealth and land variables used to identify the sample selection wage-

Table 2

Ordinary Least Squares Estimates of the Wage Function
(Dependent Variable: Log of Hourly Wage Rate)
(absolute values of t-ratios in parentheses)

Samples	African		Colored		Indian		White	
	Men	Women	Men	Women	Men	Women	Men	Women
Education								
Primary	.084 (10.6)	.062 (5.95)	.014 (.47)	.023 (.77)	-.095 (2.54)	-.082 (1.67)	-.012 (.47)	-.034 (1.87)
Secondary	.158 (14.0)	.249 (17.4)	.187 (6.36)	.199 (6.34)	.214 (5.68)	.126 (2.48)	.084 (3.03)	.052 (2.32)
Higher	.294 (9.84)	.396 (12.3)	.186 (2.89)	.307 (4.24)	.214 (6.69)	.304 (5.32)	.151 (8.38)	.139 (8.01)
Experience ($\times 10^{-1}$)	.517 (9.30)	.476 (6.75)	.610 (4.33)	.748 (5.05)	1.00 (8.08)	.828 (5.09)	1.02 (10.8)	.448 (5.98)
Experience Squared ($\times 10^{-2}$)	-.069 (7.24)	-.062 (4.90)	-.087 (3.15)	-.137 (4.62)	-.162 (5.56)	-.139 (4.04)	-.186 (8.86)	-.076 (4.59)
Rural Area	-.423 (12.7)	-.355 (8.74)	-.1088 (7.45)	-1.036 (7.09)	.149 (.49)	.105 (.17)	-.301 (2.70)	-.237 (2.47)
Constant Term	.346 (3.67)	-.212 (1.83)	.782 (3.28)	.322 (1.27)	1.180 (4.61)	1.273 (3.48)	1.817 (11.2)	2.194 (19.0)

Samples	Urban Areas				Rural Areas			
	African		White		African		White	
	Men	Women	Men	Women	Men	Women	Men	Women
Education								
Primary	.034 (3.06)	.044 (3.18)	-.004 (.18)	-.021 (1.18)	.105 (9.76)	.067 (4.36)	.028 (.19)	-.406 (3.39)
Secondary	.128 (9.22)	.195 (11.2)	.083 (2.98)	.035 (1.57)	.199 (11.5)	.319 (13.7)	.083 (.55)	.357 (3.27)
Higher	.253 (6.96)	.373 (9.38)	.151 (8.34)	.141 (8.00)	.304 (6.69)	.375 (7.27)	.048 (.59)	.095 (1.28)
Experience ($\times 10^{-1}$)	.418 (5.42)	.440 (4.78)	.933 (9.76)	.444 (5.75)	.623 (8.14)	.552 (5.23)	2.169 (6.01)	.671 (2.35)
Experience Squared ($\times 10^{-2}$)	-.056 (4.17)	-.062 (3.71)	-.162 (7.59)	-.079 (4.61)	-.084 (6.44)	-.069 (3.68)	-.547 (6.35)	-.094 (1.50)
Constant Term	.840 (6.90)	.084 (.57)	1.816 (11.1)	2.198 (18.9)	-.376 (3.12)	-.825 (5.10)	.977 (1.16)	2.871 (3.94)

earner Probit equations are jointly statistically significant only in the subsamples of African and white men and women. This suggests that for the colored and Indian subsamples the selection model is not well identified by the exclusion restrictions provided by the wealth variables. As noted by Heckman (1979), unless the estimate on the selection correction term, Lambda, is statistically different from zero, one is justified in accepting the null hypothesis that the Ordinary Least Squares (OLS) estimates are consistent and are then preferred because they are more efficient than the two-stage sample selection corrected estimates. Only among African men is our estimate of the coefficient on Lambda statistically significantly different from zero, .262 with a t-ratio of 2.99. In other words, African men with unexplained higher wage opportunities are more likely to participate in the wage labor force. Moreover, this selection effect appears to be due to the rural rather than the urban African male population. Although we report both the Heckman and OLS estimates, the OLS estimates are interpreted as the more reliable across all groups, with the exception being perhaps African men. In the case of African men, the Heckman estimates of educational returns in the wage function are slightly higher than the OLS estimates for secondary and higher schooling and marginally lower for primary schooling. Given our tenuous empirical basis for identifying the sample selection bias, any unrepresentativeness of the sample of wage earners in South Africa does not appear to bias substantially our OLS estimates of wage returns to education. Our discussion will, therefore, subsequently focus on the OLS estimates in Table 2, with the explicit recognition that further research, perhaps using additional data, should be directed toward a better empirical basis for correcting for potential sample selection bias among Africans.

The wage premia received by African men with an additional year of primary, secondary and higher (post-secondary) schooling are estimated by OLS to be 8.4, 15.8 and 29.4 percent, respectively (Table 2). African women receive a wage return for primary schooling of 6.2 percent, a 24.9 percent return on secondary education, and a return of 39.6 percent on higher education. White men evidence

no significant returns to primary schooling and for white women they are negative, -3.4 percent. However, our sample includes only 67 white men and 41 white women with less than a complete primary education of seven years on which to base the estimate of primary returns. At the secondary level white men's wages are 8.4 percent higher for each year of secondary schooling and 15.1 percent higher for each year of higher education. White women's wages are 5.2 percent higher with each year of secondary schooling and 13.9 percent higher for each year of higher education.

Among colored men primary, secondary and higher schooling have returns of 1.4 and 18.7 and 18.6 percent. Colored women earn 2.3, 19.9 and 30.7 percent wage premia for each year they completed of primary, secondary and higher education, respectively. Indian men and women have slightly higher completion rates for primary school than do whites, and evidence negative returns to this level of nearly universal primary schooling as do whites, although returns at secondary and higher levels for Indian men are 21.4 percent. Indian women receive a 19.9 percent return at the secondary level and 30.7 percent at the higher education level where their continuation rates are half those of Indian men.

The striking pattern in these estimates is that wage returns to schooling increase for most groups at increasing levels of schooling. There are exceptionally large wage gains for higher education among nonwhite men and women, 19-40 percent, substantially larger returns than received by comparably educated whites 14-15 percent. At the secondary schooling level, returns among all nonwhite groups are again roughly twice the level earned by white men, 13-25 percent compared with 8 percent. Returns are also higher for Africans in rural than in urban areas as seen in the lower panels in Table 2. Politically motivated racial quotas in South Africa that limited access of Africans to secondary and higher education under Apartheid and constrained the advancement of Colored and Indians into higher education are the simplest explanation for these high, and presumably disequilibrium, private rates of return to more advanced education among the disenfranchised racial

groups. The remainder of this paper explores in more detail the underlying features of the wage structures and how one might expect them to respond if educational quotas are relaxed.

In rural areas wages are lower, as shown in the first panel of Table 2. For African men, after controlling for education and experience, wages are 34 percent lower in rural areas than in urban areas, whereas for black women rural wages are 30 percent lower. Among white men, rural wages are 26 percent less than in urban areas, but for rural white women wages are 21 percent less. Indian and colored populations are concentrated overwhelmingly in urban areas, with 88 percent of the Indians in the old Natal province, whereas 77 percent of colored population resides in the old Cape province, with another 10 percent of the colored and Indian wage earning population in Transvaal, the highest wage province.

Residential segregation continued in 1993 to limit the opportunity of many nonwhite workers to search and accept employment outside of the areas where their racial group had established residences. Since many nonwhite residential communities allowed workers to commute to higher wage urban employment centers, the local availability of paved roads and bus transportation to reach these urban labor markets may be a valuable feature of the local community.

The wage differences associated with residing in a sample survey cluster with paved roads is estimated in Table 3, controlling for region and rural. African men, colored women, and Indian women all receive 53 to 66 percent higher wages than otherwise, if they reside in a community with "paved roads". Colored and white men receive a smaller wage premia of 22-23 percent. In those clusters that did not report local road conditions, wages for African women, colored men and women are higher. Access to the transportation system that links nonwhite residential communities to the higher wage urban labor markets, thus, appears to be associated with African men and colored workers receiving higher wages.

Table 3 also includes controls for region of residence (4 provinces and 10 homeland

Table 3

Ordinary Least Squares Estimates of the Wage Function Controlling for Regions
(absolute values of t-ratios in parentheses)

Variables	African		Colored		Indian		White	
	Men	Women	Men	Women	Men	Women	Men	Women
A. Schooling and Experience Variables								
Years of Primary Education	.066 (8.63)	.054 (5.39)	.030 (1.06)	.026 (.93)	-.067 (1.74)	-.069 (1.46)	-.006 (.25)	-.039 (2.17)
Years of Secondary Education	.135 (12.2)	.218 (15.8)	.172 (5.74)	.162 (5.16)	.211 (5.67)	.124 (2.54)	.084 (3.02)	.062 (2.78)
Years of Higher Education	.269 (9.38)	.394 (12.8)	.157 (2.49)	.315 (4.56)	.204 (6.45)	.295 (5.33)	.144 (8.06)	.139 (8.04)
Potential Experience in Years ($\times 10^{-1}$)	.461 (8.67)	.438 (6.51)	.557 (4.05)	.674 (4.76)	.994 (8.14)	.791 (5.01)	1.043 (11.1)	.482 (6.46)
Potential Experience Squared ($\times 10^{-2}$)	-.062 (6.84)	-.058 (4.80)	-.075 (2.78)	-.121 (4.30)	-.160 (5.60)	-.133 (3.94)	-.190 (9.08)	-.081 (4.90)
B. Cluster Variables								
Rural Area	-.557 (15.5)	-.591 (11.4)	-.896 (5.57)	-.735 (4.64)	-.211 (.61)	.179 (.28)	-.496 (3.46)	-.186 (1.63)
Sample cluster with tarred or paved roads	.458 (10.7)	.023 (.40)	.199 (1.85)	.422 (3.92)	-.005 (.04)	.509 (2.07)	.207 (1.84)	.080 (.87)
Sample cluster not reporting	.013 (.26)	.164 (2.38)	.633 (2.50)	.651 (2.20)			.047 (.23)	.251 (1.55)
C. Regional Variables [Transvaal is the omitted province]								
Cape	-.258 (4.03)	-.276 (3.16)	-.578 (4.09)	-.312 (2.03)			-.254 (3.41)	-.186 (2.89)
Natal	-.345 (4.32)	-.164 (1.90)	-.674 (3.68)	-.149 (.81)	-.384 (2.81)	-.438 (2.26)	-.134 (1.20)	-.289 (2.73)
Orange	-.308 (6.28)	-.597 (9.05)	-1.133 (3.05)	-1.337 (3.49)			-.094 (.77)	-.274 (2.75)

Table 3 continued

Kwazulu	.264 (5.26)	.036 (.56)						
Kangwane	.298 (3.06)	.337 (2.91)						
Qwaqwa	.210 (.99)	.457 (1.74)						
Gazankulu	.522 (4.63)	.239 (1.64)						
Lebowa	.385 (4.38)	.166 (1.73)						
Kwandebele	.461 (2.93)	.189 (1.25)						
Transkei	.258 (2.14)	.384 (2.87)						
Bophuthatswana	.489 (6.37)	.317 (3.10)						
Venda	.402 (3.08)	.233 (1.55)						
Ciskei	.167 (1.41)	.174 (1.41)						
Constant Term	.514 (5.60)	.036 (.31)	1.121 (4.03)	.408 (1.36)	1.365 (4.62)	1.150 (2.50)	2.015 (10.7)	2.136 (14.4)
R-Squared	.415	.529	.404	.485	.520	.493	.284	.219
Sample Size	2364	1533	350	312	170	107	653	527

territories). Allowing for wages to differ across these regions does not greatly affect the estimated returns to schooling within the race and gender samples. Geographical labor market differences are significant but do not appear to be responsible for the marked differences in returns by school level and race reported in Table 2.

To determine whether the high returns to post secondary schooling are realized by students uniformly across different branches of the educational system, five dummy variables are added to the OLS wage equation estimates in Table 4. These dummies are equal to one only if the individual has received this specific type of degree: a diploma course (one year at a junior/vocational training school after three years of secondary schooling), teacher training (2 years + standard 10 senior certificate), nursing (2 years + stand. 10), technikon (3.5 years + stand. 10), and completed university (3 years + stand. 10). The estimated coefficients on these specialized education degrees are only occasionally statistically significant. Because the degrees are correlated with the number of years of higher education attained, their inclusion in the wage function affects the coefficient on the years of higher education which continues to represent the average log wage increment related to each year of higher education completed by a worker.

The degree coefficients tend to be unstable, probably because of the small size of the sample of higher educated workers in the survey, and the variety of quality of training received even within one branch of the higher education system for men or women within these four race groups. A few empirical regularities may still be suggestive. African men and women with diplomas from the junior/vocational training programs receive above average wages compared to other workers with roughly the same number of years of education. This is evident for African men and women in both urban and in rural regions (See later panels of Table 4). Teacher training is not well rewarded among Africans compared with other higher educational careers; however, this wage pattern is reversed for colored and Indians. Nursing is a low paid course of study for African women and men residing in

Table 4

Ordinary Least Squares Estimates of Returns to Vocational and University Diplomas and Higher Education, by Race, Sex and Region
(absolute values of t-ratios in parentheses)

Samples Composition	African		Colored		Indian		White	
	Men	Women	Men	Women	Men	Women	Men	Women
1. Junior Diploma	.460 (2.18)	.639 (2.32)	.663 (1.21)	.241 (.49)			.049 (.33)	.240 (.88)
2. Teacher Training	-.161 (.61)	-.362 (.85)	.646 (1.62)	.843 (2.52)	1.087 (1.69)	1.165 (3.12)	-.170 (.47)	-.000 (.00)
3. Nurse Training	-.654 (1.15)	-.669 (1.53)	.872 (1.14)	.176 (.40)				
4. Technikon Diploma	-.992 (2.21)	-1.549 (2.05)			-1.081 (1.19)	.638 (1.09)	-.407 (1.22)	-.554 (2.88)
5. University Degree	-.554 (1.07)	-1.409 (1.63)	.098 (.16)	.091 (.14)	-1.249 (1.22)	.732 (1.19)	-.140 (.37)	-.317 (1.46)
6. Higher Education With Controls for Diplomas (1-5)	.454 (3.71)	.713 (3.38)	.122 (1.69)	.215 (2.11)	.516 (2.02)	.090 (.62)	.224 (2.33)	.245 (4.58)
Coefficient for Higher Education Without Controls for Diplomas	.269 (9.38)	.394 (12.8)	.157 (2.49)	.315 (4.56)	.204 (6.45)	.295 (5.33)	.144 (8.06)	.139 (8.04)

Samples Composition	Urban Areas				Rural Areas			
	African		White		African		White	
	Men	Women	Men	Women	Men	Women	Men	Women
1. Junior Diploma	.345 (1.67)	.437 (1.32)	.053 (.36)	.232 (.88)	.593 (1.14)	.804 (1.84)		
2. Teacher Training	.012 (.03)	-.469 (.69)	-.155 (.40)	-.013 (.08)	-.282 (.85)	-.349 (.65)		.691 (.91)
3. Nurse Training	-.343 (.60)	-.629 (.92)				-.610 (1.08)		
4. Technikon Diploma	-.290 (.43)	-1.388 (1.16)	-.440 (1.36)	-.558 (2.88)	-1.160 (2.04)	-1.580 (1.64)	-.062 (.16)	-.425 (.54)
5. University Degree	.450 (.58)	-1.191 (.88)	-.165 (.44)	-.340 (1.55)	-1.041 (1.58)	-1.629 (1.45)		.219 (.21)
6. Higher Education With Controls for Diplomas (1-5)	.253 (1.35)	.702 (2.09)	.232 (2.48)	.247 (4.58)	.534 (3.49)	.725 (2.71)	.077 (.63)	.117 (.49)
Coefficient for Higher Education Without Controls for Diplomas	.254 (1.18)	.388 (9.97)	.146 (8.10)	.137 (7.92)	.286 (6.95)	.416 (8.83)	.063 (.74)	.098 (1.27)

urban or rural areas, but not for colored persons. The relatively few African graduates of Technikons report wage returns below the average for higher education, and this is also evident for other race groups, although the differences are only significant for white women. University degrees are not associated with unusually high wages given the three years of study it is assumed to require.[6]

5. DECOMPOSITION OF RACE DIFFERENCES IN WAGES

Table 5 reports the results of a decomposition of the differences in wages received by various race groups in South Africa, where the objective is to assess how much of these wage differences would be eliminated if the nonwhite groups received the human capital characteristics of the white population, but continued to be rewarded on the basis of the estimated wage functions for the nonwhite group (Oaxaca, 1973; see derivation in Appendix B). The first two rows from Table 1 repeat the average proportion of persons participating as a wage earner and the average logarithmic wage for wage earners in each of the eight race and sex subsamples. Rows 3 and 4 report the predicted log wage for the entire population age 16-65 assuming nonwage earners receive the wage rate that is implied, first by the preferred OLS (Table 2), and then by the Heckman sample-selection-corrected wage model (Table A-3). Row 5 reports the difference between the log wage of each nonwhite wage earner sample and the corresponding white sample from row 2. This racial difference in wages or wage gap would be partially closed if (1) the educational attainment of the nonwhite group were raised to that of the white group of the same sex, and (2) education is rewarded by a positive wage premium. The

---

[6] The various categories of higher education reported by individuals in the survey may have involved different numbers of years of study for different individuals at different institutions and at different times. We consulted a variety of sources to obtain our estimates reported in Appendix Table A-2 and summarized in the text. Any systematic error in our estimates of years required for each type of higher education category could then bias the degree category coefficients reported in Table 4. For example, suppose that university degrees required on average four years of study, and we assumed standard 10 plus only three years. Then the university coefficient in Table 4 would be downward biased by about the level of the private rate of return per year for all of higher education estimated in the regression with degree dummy variables.

Table 5

Differences between Log Wages by Race and Sex as Accounted for by Years of Education, Experience, and Rural Location[a]

	African		Colored		Indian		White	
	Men	Women	Men	Women	Men	Women	Men	Women
1. Proportion of Persons with a Wage	.254	.146	.365	.290	.468	.260	.451	.347
2. Mean Log Wage (or Predicted Wage for Wage Earners)	1.559	1.182	1.969	1.619	2.552	2.098	3.326	2.760
3. Mean of OLS Predicted Log Wage for All Persons (Table 2)	1.370	.838	1.871	1.456	2.386	1.922	3.155	2.683
4. Sample Selection Corrected Predicted Log Wage for All Persons (Table A-3)	1.028	1.041	2.242	1.502	2.472	1.990	3.001	2.925
Wage Earners								
5. Difference in Log Wage of Whites and this Non-White Group (row 2)	1.767	1.578	1.357	1.141	.774	.662	0	0
Share of Wage Gap (5) Accounted for by White Characteristic:								
6. Education	.522	.555	.458	.536	.373	.329	-	-
7. Experience	-.055	-.073	-.039	-.063	.032	.132	-	-
8. Location	.119	.091	.030	.028	.009	.009	-	-

[a] Without controls for diplomas, provinces, or infrastructure.

proportion of the gap closed by this simulated increase in nonwhite group's education is then evaluated, based on the OLS regression coefficients for each nonwhite subsample's wage function (Table 2), and reported in row 6. Row 7 reports the analogous share of the wage gap closed if the nonwhite group's postschooling experience (or essentially age of workers) is set equal to that of the white group. Row 8 reports the analogous share of the wage gap closed if the rural/urban residential distribution of the nonwhite group is shifted to that of the white wage earner group.

Increasing the educational attainment of the Africans to those of whites would close about 52 percent of the wage gap for men and 56 percent of the wage gap for women (row 6, Table 5). For colored men and women the effect would be to reduce the wage gap by 46 and 54 percent, respectively. Thirty-seven and 33 percent of the wage gap of the Indian men and women would be eliminated by attributing to them the white levels of education. As nonwhite groups increase their educational attainments, it is likely that their currently high rates of wage return to education at the secondary and higher education levels will decline toward those received by the more widely educated whites. Thus, these decomposition estimates probably overstate the general equilibrium wage gain that nonwhites could expect to achieve if they were able to secure the educational attainments that whites have already obtained in South Africa.

Experience (or age) does not differ greatly between the race groups, and thus equalizing experience affects only slightly (negatively) the wage gap for blacks and colored, who are generally older than whites (because of unemployment among the young whites), whereas for Indians this change in experience distribution would close the wage gap by 13 percent for women who are much younger than whites, and by 4 percent for men.

Changing the residential location of nonwhite groups would probably have a moderate effect on group wages. African men would eliminate 12 percent of the wage gap if they were relocated to urban regions in proportion to whites. African women would eliminate 9.1 percent of their wage gap

from this residential change. The wage gap of colored men and women would decrease by only 2.8-2.9 percent if they are relocated to the regions where whites reside. The wage gap of Indian men and women is reduced by less than one percent by regionally redistributing them to the white regions. As with education, these simulated gains from relocation probably overstate potential wage benefits. Urban wages would presumably decrease and rural wages increase in adjustment to any large-scale migration of workers from poor rural regions toward the higher wage urban regions of South Africa. In both the cases of education and location, the redistribution of nonwhite characteristics might be expected to also erode the "rents" currently accrued by whites from their superior educational status and location that was heretofore maintained partly by their political power[7]

These wage decompositions are premised on the nonwhite group's wage function remaining unchanged. The polar alternative assumption is that the nonwhites take on the characteristics of the whites, but are now rewarded according to the white wage functions (Table 2). Using the white wage function estimates to evaluate the effect of the equalization in education and location would clearly lead to much smaller advances in nonwhite wages because white wage returns to schooling and urban residence are generally smaller than for Africans.

There are two reasons why the average wages available to all persons might differ from those that the sample of wage earners received. First, the observable characteristics of the wage earners that are included in the estimated wage function (e.g., education and location) may differ from the characteristics of those not earning a wage. In all eight race-sex subsamples this compositional effect based on worker observables, implies the wage rate available to all persons (including those not earning a wage) would be from 1 to 34 percent lower than that received by wage earners within the race-sex subsamples (compare rows 2 and 3 in Table 5) with the largest differences being for African women,

---

[7] Including the effects of regional areas (provinces and homelands) and community road infrastructure does not increase substantially the residential location effect on the wage gap for Africans but does increase the wage gap closed for coloreds and Indians.

and the smallest for white women.[8] Second, any correlation between unobservables that affects the propensity to participate as a wage earner and that influences wages implies an additional adjustment in the wages of those not working for a wage that is a function of the magnitude and sign of the coefficient estimated for Lambda in the Heckman selection model (compare rows 3 and 4 in Table 5). The estimate of this adjustment is sensitive to the specification of the sample selection correction model, both in terms of the identifying exclusion restrictions discussed earlier and possibly the functional form of the Probit. Our estimates, with their noted limitations, of the selection corrected wage function implies that the sample selection bias reduces the average log wage of all persons compared to that predicted on observables for African men by -.34, for white men by -.14. But for the other race and gender groups the implied effect of unobservables is positive. For African women the estimated selection corrected log wage rates for all persons are .20 greater than predicted only on observables (i.e., OLS), colored men are .37 greater, and colored women are .05 greater and log wages of Indian men and women are .09 and .07 greater, respectively. These selection bias corrected wage estimates as statistically reliable, however, only in the case of African men, and should thus be interpreted with much caution for the other groups.

6. EXPLANATIONS FOR RETURNS TO SCHOOLING

In the long run, returns to schooling are expected to be lower at more advanced levels of education, if the educational system and labor market are free to respond efficiently to market incentives (Becker, 1975). But this structure of decreasing returns follows from the assumption that individuals invest in schooling until their marginal return declines to the prevailing cost of capital. If

---

[8] The difference between the actual mean log wage of wage earners (row 2, Table 5) and the mean log wage predicted for all persons age 16-65 based on the OLS estimates of the wage equations (Table 2) that neglect sample selection bias (row 3, Table 5) is -.19 for African men, -.34 for African women, -.10 for colored men, -.16 for colored women, -.17 for Indian men, -.18 for Indian women, -.17 for white men, and -.077 for white women.

instead the proportion of each race/gender birth cohort investing in a specific level of education is rationed by the government for political purposes, as in South Africa, members of these rationed groups who obtain more advanced education could receive "excess" returns.[9] If each racial group operated its own economy in autarky using its own labor but it had access to the same technology and capital markets, then the group with a larger proportion of educated adults would expect to receive lower returns to its education at each level of education.

To explore the explanatory power of this simple rationed supply hypothesis in South Africa to account for variation in returns to education, we reestimated our wage functions, as specified in Table 2, for the eight race/gender groups within three age cohorts (16-29, 30-44, 45-65) (see Table A-5). Second-stage weighted regressions are then estimated in Table 6 to explain the estimated returns at the primary, secondary and higher schooling levels by the proportion of that cohort's race/sex/age group supplying that level of education, controlling for differences in level by sex and age.[10] The effect of the cohort supply variable on returns is statistically significant and negative, ranging in value from -.6 to -.2 to -.5 for the primary, secondary and higher levels, respectively. When the three levels of schooling are pooled, allowing the intercept to shift by school level, the coefficients on educational supplies by

---

[9] It is assumed here that any abilities that are complementary to the returns from education are uniformly distributed across the different groups, but this assumption is relaxed elsewhere (Mwabu and Schultz, 1996). The other commonly considered hypothesis for group differences in educational investment is credit constraints, which could plausibly increase the cost of borrowing for African compared to white groups, reducing the incentive for Africans to invest in as much schooling as whites. National examinations are set for different racial groups to determine which primary school graduates may advance to secondary school, and which secondary school graduates may enroll at a higher educational institution. These exams ultimately function as a race-specific rationing device, although credit constraints could reinforce this restriction mechanism. Estimated graduation rates by race, gender and age are provided in the next to last column in Table A-5.

[10] The OLS regressions estimates of the three school return parameters for the 24 race/sex subsamples are reported in Appendix Table A-5, along with their standard errors, and the proportions with that level of schooling, with the specification as in Table 2. The regressions in Table 6 are weighted by the inverse of the regression coefficient standard errors. One cell is empty, that for the oldest age group of higher educated Indians, and hence only 23 observations are available for higher education coefficients, and 71 in the overall regressions.

Table 6

Determinants of Wage Returns to Schooling across Four Race Groups in South Africa, by Sex, Age and Schooling Levels[a]
(absolute values of t-ratios in parentheses)

	Primary	Secondary	Higher	All	All
Supply Proportion with School Level)[b]	-.589 (3.92)	-.211 (2.77)	-.505 (4.73)	-.278 (8.49)	-.317 (5.24)
Sex (Male=1)	-.012 (.42)	-.061 (2.16)	.0074 (.27)	-.020 (1.20)	-.022 (3.44)
Age 16-29 (=1)	.108 (2.45)	.068 (1.67)	.101 (2.70)	.078 (3.49)	.083 (2.30)
Age 30-44 (=1)	.104 (3.07)	.0090 (.24)	.0784 (2.10)	.046 (2.29)	.048 (2.30)
Secondary (=1) Education	-	-	-	-	.0066 (.24)
Higher (=1) Education	-	-	-	-	-.0433 (1.07)
Constant	.438 (4.12)	.285 (6.00)	.234 (5.97)	.245 (9.57)	.271 (5.79)
R^2	.475	.437	.618	.562	.585
Sample Size	24	24	23	71	71

[a] Generalized least squares estimates based on data in Table A-5.
[b] Definition of supply variable provided in footnotes to Table A-5.

the three school levels are not statistically significantly different. The preferred model is thus one with a common supply effect of -.32 (last column Table 6) across all levels of schooling.

The returns to schooling and proportions educated across race, age and sex groups are plotted in Figure 1 along with the weighted regression line. According to these estimates, increasing the proportion of younger Africans with higher education from 4 percent to 14 percent might be expected to reduce the returns by only one-tenth among the youngest cohort of Africans, from 31.7 percent to 28.5 (i.e., .1 * (-.32)= -.032). It is also important to note that returns are about 8 percent higher among the cohort age 16-29, and 4 percent higher among the cohort age 30-44, than among the (omitted) older group aged 45-65. Thus, despite the evidence that the quality of African schooling deteriorated in the 1980s (Moll, 1992b, 1995), wage returns for schooling are nonetheless highest in 1993 among the youngest cohort of Africans at all three levels of education (Table A-5).

7. CONCLUSIONS

In South Africa wage rates of whites are roughly five times as large as those for Africans, three times the wages of coloreds, and twice those of Indian workers. These unusually large differences in wages between racial groups appear to be almost half due to differences in years of education of the nonwhite compared to white groups (Table 5, row 6). Undoubtedly more of the difference in wages could be explained if quality differences in the education that the various racial groups have received could be held constant. Moll observes that in the 1960s, five times the public resources were spent on a year of white secondary education as on African. Even in 1990, the differential was still two to one (Moll, 1992a, 1992b). On the other hand, if Africans were as well educated as whites, their returns to education would probably decline and their wages would not rise by the projected twofold.

It is more difficult to evaluate the importance we have found for region of residence in the wage structure of various racial groups. Although most colored workers reside in urban areas, regional

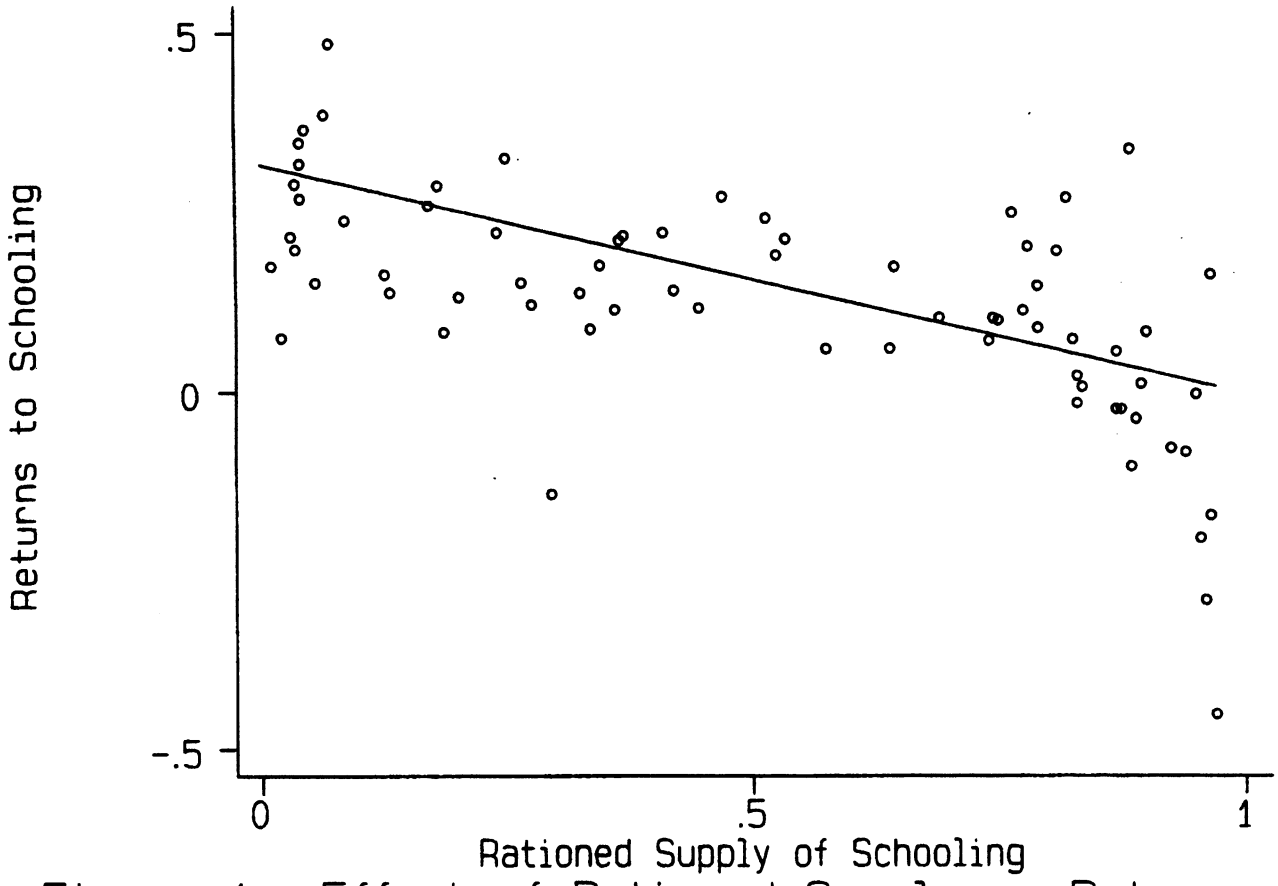

Figure 1 : Effect of Rationed Supply on Returns

residential patterns still explain three percent of their lower wages compared with that of whites. Nine to twelve percent of the lower level of wages of African men and women is related to their greater rural residential location, respectively, which differs markedly from that of whites. How much of this share of the wage gap could be closed by decreased residential segregation and increased labor mobility can only be assessed through repeated cross sectional studies that are not currently available, or by panel studies that follow individuals over time as the barriers of apartheid are eroded.

Sample-selection bias does not appear to be an important source of wage distortion between education groups in these populations, except perhaps for African men. With a theoretically better justified foundation for empirically identifying sample selection bias in estimating the wage function that would account for both rural-urban migration and selection into wage employment (Vijverberg, 1993), the wage structures described in this paper might be substantially modified. This possibility deserves more study, because of the relatively small proportion of Africans in the wage labor force, 25 percent of men and 15 percent of women (Table 5, row 1). However, given our available data, no indication was found that such sample selection bias would change the broad outlines of the findings reported here of differential returns to schooling favoring Africans and nonwhites.

Wage returns to primary education are moderate for Africans (6-8 percent) and generally insignificant or negative for Colored, Indians and whites. This is not an uncommon pattern as a population approaches high levels of enrollment at the primary level. Only 6 percent of white and Indian males age 16-65 have not completed primary schooling, and this relatively small group must define whatever wage returns are estimated for this level of schooling. Another possibility is that some African workers in the survey with no more than a primary education are immigrants (e.g., from Mozambique or Zimbabwe) who could be positively self-selected (on unobservables) into the country, and may be atypically well-motivated and productive, given their low educational attainment.[11] The

[11] According to the survey, however, only one percent of the African male wage earners age 16 to 65 with less than a secondary education report being born in another country.

estimated returns to Africans born in South Africa from attending primary education may consequently be biased downward slightly by our neglecting immigration. Native-born Africans with the least primary schooling are also likely to have had access to the lowest quality primary schools, providing another possible explanation for the low-wage returns at this level of schooling. Finally, primary schooling has an additional value if it provides an individual with the option to invest in additional higher-return secondary and higher education. Part of the high returns to secondary and higher education for Africans can thus be viewed as a benefit that may only be realized by first completing primary school.

The strongest empirical regularity in these data is that wage returns to education increase with the level of education, and decrease with the average educational attainment of the race and sex group.[12] Thus, private and social priorities should favor increasing the supply of secondary and higher educated workers in South Africa, particularly among the least educated racial groups i.e., black Africans. Wage returns to Africans for a year of secondary education are nearly twice as large as the corresponding returns for whites, 16 versus 8 percent for men and 25 versus 5 percent for women (Table 2). At the higher education level African returns are 29-40 percent versus 14-15 percent for whites, for both sexes. Expansion of secondary and higher education for Africans has the attraction of both increasing income and growth efficiently, while also reducing the overall racial inequality of income by investing in the less affluent racial groups. It is nonetheless likely that as racial barriers

---

[12] Elsewhere we estimate quantile wage regressions to evaluate whether estimates of the wage returns to education decrease from the top to the bottom of the distribution of wage residuals for various race and sex groups in South Africa (Mwabu and Schultz, 1996). Only among the whites is there evidence that the returns to higher education decrease markedly among the lower deciles of the distribution of wage residuals. This pattern suggests that reducing the proportion of whites attending higher education by raising the admission standards might increase the average wage return to those matriculating. For Africans the data do not confirm that a similar increase in returns would be achieved by retrenchment in secondary and higher education for this group, which could suggest that expansion of the education for Africans will not immediately lead to an observable deterioration in educational quality, or at least to a noticeable decline in the additional marketable skills that these levels of education currently provide African workers.

diminish in the labor market, the scarcity value of highly educated Africans will increase further, widening inequality of earnings among Africans, while narrowing inequality between Africans and whites as groups. It is also likely that inequality in wages for whites will increase as the level of wages of less educated whites will diminish toward the levels of African workers with the same schooling. Moll (1995) has already reported evidence that wage inequality is increasing within race groups from the 1980s to the 1990s, while wage inequality is decreasing between Africans and whites as groups.

Compared with studies in Latin America and South Asia, the private wage returns to secondary and higher education among Africans in South Africa are relatively high (Schultz, 1988). Even in comparison with the East Asian miracle countries, private wage returns to Africans with higher education are extraordinarily high. But this might be expected on the basis of the past political rationing of schooling to nonwhites which has contributed to the relative scarcity; only two to three percent of the labor force-aged African population has any higher education, compared with 35 and 20 percent of the comparable white men and women. If the public resource costs of white education are still many times larger than those of African education, as Moll (1992b) documents, then the social returns from expanding the secondary and higher educational system for Africans are considerably larger than expanding the parallel systems for whites. If the educational system for the different races merge, as is projected, private and social returns should strongly favor the expansion of the system to accommodate more qualified African students.

Differences in returns to various degree programs in higher education may change markedly as these occupational specialties cease to be racially segregated. Junior diplomas appear to be well rewarded in the job market for Africans, but this category of degree may be quite heterogeneous. To attract talented young people into teaching in the African secondary school system, it may be necessary to raise the relative level of salaries for qualified and competent teachers. Otherwise few Africans will pursue this career given the structure of wages prevailing in 1993. University education does not

appear to offer extra rewards over other forms of higher education in any race or gender group. This may signal other amenities of employment that are enjoyed by university graduates, or a related lack of extreme scarcity of these talents compared with other skills produced in more applied programs of higher education. Nonetheless, in the longer view, continued expansion of university education would seem justified to maintain the overall development and balance of higher education, when returns on average to tertiary education are exceptionally high. In the short run, economic returns for private individuals, and perhaps for society, encourage increasing the quantity and improving the quality of African secondary schools, while at the same time expanding selectively the African higher educational system in those fields where wage returns remain consistently high.

REFERENCES

Ainsworth, M., and J. Munoz. (1986), "The Côte d'Ivoire Living Standards Survey," Living Standards Measurement Study Working Paper No. 26, The World Bank, Washington, D.C.

Becker, G.S., 2nd Ed. (1975), Human Capital, NBER, New York: Columbia University Press.

Cain, G.G. (1986), "The Economic Analysis of Labor Market Discrimination." In Handbook of Labor Economics, Vol. 1, pp. 693-785, eds. O.C. Ashenfelter and R. Layard. Amsterdam: North-Holland Pub., Co.

Deaton, A. (1994), "Large Transfers to the Elderly of South Africa." Princeton University, Princeton, NJ.

Griliches, Z. (1977), "Estimating the Returns to Schooling: Some Econometric Problems," Econometrica, 45(1):1-22 (January).

Grosh, M., and P. Glewwe. (1995), "A Guide to Living Standards Measurement Study Surveys and Their Data Sets," Living Standards Measurement Study Working Paper No. 120, The World Bank, Washington, D.C.

Heckman, J. (1979), "Sample Selection Bias as a Specification Error," Econometrica, 47(1):153-161 (January).

Iyengar, M., and R.C. Porter. (1990), "South Africa Without Apartheid: Estimates from General Equilibrium Simulations," Journal of International Development, 2(1):1-59.

Knight, J.B., and M.D. McGrath. (1977), "An Analysis of Racial Wage Discrimination in South Africa," Oxford Bulletin of Economics and Statistics, November.

Lipton, M. (1985), Capitalism and Apartheid: South Africa, 1910-1984. Aldershot: Gower Publ. Co.

Mincer, J. (1974), Schooling, Experience and Earnings. New York: Columbia University Press.

Moll, P.G. (1992a), "The Decline of Discrimination against Colored People in South Africa, 1970-1980," Journal of Development Economics, 37:289-307.

_____. (1992b), "Quality of Education and the Rise in Returns to Schooling in South Africa, 1975-1985," Economics of Education Review, 11(1):1-10.

_____. (1993a), "Black South African Unions: Relative Wage Effects in International Perspective," Industrial and Labor Relations Review, 46(2):245-261.

_____. (1993b), "Industry Wage Differentials and Efficiency Wages," Journal of Development Economics, 41:213-246.

_____. (1995), "The Collapse of Primary School Returns in South Africa, 1960-1990," processed, Mt. Prospect, IL.

Mwabu, G., and T.P. Schultz. (1996), "Education Returns Across Quantiles of the Wage Function," American Economic Review, 86(3).

Oaxaca, R.L. (1973), "Male-Female Wage Differentials in Urban Labor Markets," International Economic Review, 14(3):693-709.

Rosen, S. (1977), "Human Capital: A Survey of Empirical Research." In Research in Labor Economics, Vol. 1, ed. R.G. Ehrenberg. Greenwich, CT: JAI Press.

SALDRU. (1994), South Africans Rich and the Poor: Baseline Household Statistics, School of Economics, University of Cape Town, Cape Town.

Schultz, T.P. (1988), Education Investment and Returns." In Handbook of Development Economics, Vol. 1, eds. H. Chenery and T.N. Srinivasan. Amsterdam: North-Holland Pub. Co.

____. (1994), "Human Capital and Economic Development," proceedings of International Agricultural Economists Conference, Harare, Zimbabwe, 1995.

Thompson, L. (1990), A History of South Africa, Yale University Press, New Haven, CT.

Vijverberg, W. P. M. (1993), "Educational Investments and Returns for Women and Men in Côte d'Ivoire," Journal of Human Resources, 28(4):933-974.

Welch, F. (1975), "Human Capital Theory: Education, Discrimination and Life Cycles," American Economic Review, 65(2):63-73 (May).

Table A-1

Means of Variables included in Wage and Wage Participation Equations, by Race and Sex
(Standard Deviations in Parentheses and Sample Sizes in Brackets)

Variables	African		Colored		Indian		White	
	Men	Women	Men	Women	Men	Women	Men	Women
Dependent Variables								
Wage earner (proportion of sample)	.254 [9325]	.146 [10473]	.365 [958]	.290 [1075]	.468 [363]	.260 [411]	.451 [1447]	.347 [1517]
Logarithm of hourly wage rate (wage earners)	1.559 (.94) [2364]	1.182 (1.05) [1533]	1.969 (.95) [350]	1.619 (.94) [312]	2.552 (.71) [170]	2.098 (.77) [107]	3.326 (.82) [653]	2.760 (.61) [527]
Independent Variables a. Schooling and Experience	[2364]	[1533]	[350]	[312]	[170]	[107]	[653]	[527]
Years of primary education	5.27 (2.55)	5.59 (2.40)	6.30 (1.77)	6.28 (1.66)	6.73 (1.24)	6.63 (1.41)	6.66 (1.47)	6.31 (2.01)
Years of secondary education	1.42 (1.87)	1.73 (1.97)	2.07 (1.82)	2.10 (1.88)	3.67 (1.68)	3.60 (1.60)	4.15 (1.48)	3.89 (1.79)
Years of higher education	.11 (.57)	.22 (.71)	.16 (.70)	.13 (.60)	.56 (1.34)	.45 (1.11)	1.39 (1.76)	.96 (1.53)
Has a junior diploma (x 100)	.51	.46	.57	.64	--	--	3.83	.75
Has teacher training (x 100)	1.86	1.04	1.43	2.24	--	--	.77	3.99
Has training in nursing (x 100)	.08	2.15	.29	.96	--	--	--	--
Has a technikon diploma (x 100)	1.14	1.04	--	--	4.12	2.80	23.7	11.00
Has a university degree (x 100)	.68	.78	.57	.64	9.41	4.67	12.6	9.68
Potential job experience in years	24.73 (12.4)	24.03 (11.9)	21.14 (10.9)	20.19 (10.7)	18.91 (11.5)	16.09 (11.9)	19.17 (11.0)	18.53 (11.8)

Table A-1 continued

b. Regions [Transvaal] and Sample Clusters	[2364]	[1533]	[350]	[312]	[170]	[107]	[653]	[527]
Homelands (10 regions for Africans) (x100)	33.46	41.88	--	--	--	--	--	--
Cape (x 100)	6.22	5.61	77.43	77.89	--	--	17.15	17.65
Natal (x 100)	3.89	6.00	10.00	10.58	88.23	89.72	8.27	6.45
Orange Free State (x 100)	12.14	10.89	2.57	3.53	--	--	5.51	7.45
Rural (x 100)	56.13	47.03	--	--	--	--	6.59	6.83
Sample cluster with tarred roads (x 100)	16.58	16.05	64.57	65.71	89.41	93.46	85.30	85.20
Sample cluster not reporting (x 100)	16.41	18.00	5.43	5.45	1.12	.93	3.22	3.60
c. Wage Earner Identifiers	[9325]	[10473]	[958]	[1074]	[363]	[411]	[1447]	[1517]
Market value (in 1,000 rand) of nonfarm assets	.48 (4.45)	.54 (5.10)	.33 (2.26)	.45 (2.98)	2.41 (18.1)	1.99 (16.6)	19.66 (100.8)	17.34 (95.38)
Rental income (in 1,000 rand) from nonfarm assets received over the past 12 months	.02 (.26)	.02 (.28)	.08 (1.99)	.09 (.57)	.27 (2.23)	.47 (3.47)	1.18 (21.07)	1.13 (20.69)
Does any person in the household receive rental income from nonfarm assets? (1=yes) (x 100)	.87	.91	3.65	4.65	4.68	5.60	4.36	3.88
Market value of equipment (in tens of rand) used in self-employment	.46 (18.3)	.01 (.77)	8.15 (199.9)	.56 (18.3)	.69 (9.45)	.73 (14.8)	1926.50 (32193)	740.10 (28243)
Does a household have a right to use land for crop farming? (1=yes) (x 100)	22.40	23.66	--	--	27.55	24.33	4.91	4.42

Table A-1 continued

Hectares of land that cannot be sold	.66 (10.6)	.38 (4.43)	--	--	--	--	5.19 (79.9)	4.68 (76.9)
Proportion of land that can be irrigated with the available water (x 100)	2.51 (15.11)	2.34 (14.42)	--	--	--	--	2.11 (12.88)	1.71 (11.72)
Does a household have a right to use the land for stock farming? (1=yes) (x 100)	17.86	18.87	.31	.37	--	--	5.53	5.27
Does a household have a right to sell part of the land it uses for crop farming? (1=yes) (x 100)	.50	.55	.21	.19	--	--	3.04	2.57
Hectares of crop land that a household can sell	.008 (.19)	.006 (.15)	--	--	--	--	45.81 (821.4)	18.32 (466.1)
Market value of land (in rand) that can be sold	96.04 (3327)	115.39 (3582)	--	--	--	--	476.09 (6666)	638.03 (7988)
Annual interest income (in rand) from non-employment sources	.79 (17.97)	.44 (12.46)	.34 (7.95)	.53 (10.5)	38.38 (265)	22.26 (183)	129.23 (2034)	138.82 (2000)

-- : This variable has been excluded from model specification for this sample to facilitate estimation, because it varies for only a small proportion of the sample.

Table A-1 continued

Urban and Rural Areas: Means of Variables included in Wage and Wage Participation Equations, by Race and Sex (Standard Deviations in Parentheses and Sample Sizes in Brackets)

Variables	Urban Areas				Rural Areas			
	African		White		African		White	
	Men	Women	Men	Women	Men	Women	Men	Women
Dependent Variables								
Wage earner (proportion of sample)	.343 [3025]	.238 [3394]	.464 [1314]	.356 [1380]	.210 [6300]	.102 [7079]	.323 [133]	.262 [137]
Logarithm of hourly wage rate (wage earners)	1.923 (.72) [1037]	1.413 (.86) [809]	3.343 (.80) [610]	2.778 (.59) [491]	1.273 (.99) [1327]	.924 (1.18) [724]	3.075 (1.10) [43]	2.518 (.79) [36]
Independent Variables a. Schooling and Experience	[1037]	[809]	[610]	[491]	[1327]	[724]	[653]	[36]
Years of primary education	5.85 (2.18)	6.02 (2.04)	6.64 (1.49)	6.28 (2.05)	4.82 (2.71)	5.12 (2.67)	6.81 (1.07)	6.78 (1.17)
Years of secondary education	1.84 (1.93)	1.89 (1.90)	4.13 (1.50)	3.86 (1.82)	1.09 (1.76)	1.56 (2.04)	4.37 (1.25)	4.28 (1.34)
Years of higher education	.12 (.59)	.19 (.68)	1.36 (1.75)	.97 (1.54)	.11 (.56)	.27 (.75)	1.80 (1.80)	.89 (1.52)
Has a junior diploma (x 100)	.97	.49	3.93	.81	.15	.41	2.33	--
Has teacher training (x 100)	1.54	2.84	.66	4.07	2.11	8.01	2.33	2.78
Has training in nursing (x 100)	.19	2.23	--	--	--	2.07	--	5.56
Has a technikon diploma (x 100)	1.25	.99	22.6	11.0	1.06	1.11	39.54	11.11
Has a university degree (x 100)	.77	.99	12.8	9.78	.60	.55	9.30	8.33
Potential job experience in years	24.82 (11.6)	24.33 (11.2)	19.28 (11.0)	18.43 (11.7)	24.66 (12.9)	23.69 (12.6)	17.73 (11.1)	19.90 (13.9)

Table A-1 continued

b. Regions [Transvaal] and Sample Clusters	[1037]	[809]	[610]	[491]	[1327]	[724]	[43]	[36]
Homelands (10 regions for Africans) (x100)	14.95	16.44	--	--	47.93	70.30	--	2.78
Cape, Natal, Orange Free State (x 100)	24.68	26.82	31.54	30.76	20.35	17.68	12.55	27.78
Sample cluster with tarred roads (x 100)	22.28	29.54	90.49	89.82	12.13	.97	11.63	22.22
Sample cluster not reporting (x 100)	6.65	6.67	3.44	3.67	24.04	30.66	--	2.78
c. Wage Earner Identifiers	[3025]	[3394]	[1314]	[1380]	[6300]	[7079]	[133]	[137]
Market value (in 1,000 rand) of nonfarm assets	.64 (4.85)	.72 (5.71)	18.65 (101.1)	16.45 (96.8)	.405 (4.24)	.459 (4.78)	29.72 (97.3)	26.36 (78.94)
Rental income (in 1,000 rand) from nonfarm assets received over the past 12 months	.04 (.30)	.04 (.34)	1.28 (22.1)	1.22 (21.7)	.007 (.24)	.008 (.25)	.21 (1.10)	.15 (.86)
Does any person in the household receive rental income from nonfarm assets? (1=yes) (x 100)	2.64	2.88	4.43	3.91	.01	.01	3.79	3.68
Market value of equipment (in tens of rand) used in self-employment	.61 (21.30)	.003 (.002)	2001.90 (33530)	813.22 (29611)	.38 (16.7)	.015 (.93)	118.02 (1301)	4.37 (51.3)
Does a household have a right to use land for crop farming? (1=yes) (x100)	.19	.41	1.52	1.59	33.06	34.81	38.35	32.85
Hectares of land that cannot be sold	.0012 (.03)	.0022 (.04)	1.19 (20.4)	.86 (14.3)	.97 (12.9)	.99 (.08)	44.74 (253.3)	43.08 (249.5)
Proportion of land that can be irrigated with the available water (x 100)	.04 (1.87)	.19 (4.29)	.48 (6.19)	.51 (6.51)	3.69 (18.10)	3.37 (17.19)	18.23 (33.9)	13.87 (30.61)
Does a household have a right to use the land for stock farming? (1=yes) (x 100)	.03	.12	1.83	2.03	26.40	27.86	42.11	37.96

Table A-1 continued

Does a household have a right to sell part of the land it uses for crop farming? (1=yes) (x 100)	.001	.001	.46	.36	.01	.01	28.79	19.3
Hectares of crop land that a household can sell	.0003 (.02)	.0008 (.04)	1.74 (31.5)	.42 (15.4)	.007 (.15)	.007 (.14)	243.58 (1340)	99.26 (772.6)
Market value of land (in rand) that can be sold	1.98 (109.1)	3.24 (134.0)	179.7 (4725)	313.5 (5974)	139.9 (4045)	168.76 (4356)	1940.9 (8199)	2155.3 (9372)
Annual interest income (in rand) from non-employment sources	1.44 (26.89)	.65 (17.6)	77.89 (436.1)	89.1 (483.3)	.480 (11.4)	.341 (8.98)	636.47 (6569)	640.15 (6477)

-- : This variable has been excluded from model specification for this sample to facilitate estimation, because it varies for only a small proportion of the sample.

Table A-2

Variable Definitions and Sources in Survey Questionnaires

Variables & Sources	Definitions
a. Individual and Household-level Variables	
Education (0-16 years): Question 1.6, p. 5; codes 1-19, p. 4	Years of schooling (codes 17-19 were set equal to zero)
Primary Education (0-7 years): Question 1.6; codes 1-5)	Years of primary education (two extra years were attributed to substandards A and B; hence standard 1 equals 3 years, standard 2 equals 4 years etc.)
Secondary Education (0-5 years): Question 1.6; codes 6-11)	One year of secondary education was assigned to persons receiving diplomas from vocational/junior colleges after completing standards 7, 8 or 9
Higher Education (0-4 years): Question 1.6; codes 12-16)	Years of post-secondary education (four years of higher education were assigned to a university degree, 3.5 years to a technikon diploma, 2 years to some university education and 2 years to teacher or nurse training)
Other Education (Question 1.6; codes 11-15): a. Standard 7, 8 or 9 + diploma b. Standard 10 + teacher training c. Standard 10 + nursing d. Standard 10 + technikon diploma e. Standard 10 + 2 years of university without degree f. Standard 10 + 4 years with university degree	Standards 7, 8 or 9 + diploma were set equal to 1 for persons with some secondary education plus a diploma and equal to zero otherwise; and similarly for (b through f)
Job Experience (Questions 1.5 and 1.6, p.5)	Potential job experience (Age in years minus years of schooling minus six)
Job Experience Squared	Square of Potential JobExperience
Sex (Question 1.4, p. 5)	1 = Male and 0 = Female
Race (Question 19, p. 2) a. African b. Colored c. Indian d. White	The four major population groups in South Africa (codes 1-4 of Question 19)

Table A-2 continued

Variables & Sources	Definitions
b. Cluster and Regional Variables	
Tarred Roads; Sample Clusters Not Reporting (Community Questionnaire, p.3)	Tarred Roads equals 1 for individuals reporting tarred or paved roads in their communities and zero otherwise; similarly, Sample Clusters Not Reporting equals 1 for individuals in communities without responses to roads questions
Regions (METRO Data File, Number 60, p. 66)	Rural equals code 3 for the metro variable in the METRO Data File, while Urban equals codes 1 and 2 inclusive of peri-urban areas. Individuals in sample clusters 193-360 are in homelands (codes 5-14) of old provinces: Cape=1, Natal=2, Transvaal=3, Orange Free State=4, Kwazulu=5, Kangwane=6, Qwaqwa=7, Gazankulu=8,Lebowa=9, Kwandebele=10, Transkei=11, Bophuthatswana=12, Venda=13, Ciskei=14.
c. Wage Earner Identifiers	
Nonfarm Assets (Question 7.2.2b)	Market Value (in 1,000 rand) of nonfarm assets
Rental Income (Question 7.2.2d)	Rental Income (in 1,000 rand) from nonfarm assets received over the past 12 months
Income from Nonfarm Assets (Question 7.2.2c)	Is any rent being received from nonfarm assets? (1=yes)
Self-employment Equipment (Question 5g)	Market value of equipment (in tens of rand) used in self-employment
Crop Farming Rights (7.1.1a)	Does a household have a right to use land for crop farming? (1=yes)
Land Not Available for Sale (Questions 7.1.4 and 7.1.8a)	Hectares of land that the household cannot sell
Land that Can Be Irrigated (Question 7.1.6c)	Proportion of crop land that can be irrigated using the available water sources
Stock Farming Rights (Questions 7.1.2b)	Does a household have the right to use the land for stock farming? (1=yes)
Right to Sell Crop Land (Question 7.1.7)	Does a household have the right to sell part of the land it uses for crop farming? (1=yes)
Crop land that can be sold (Question 7.1.8a)	Hectares of crop land that a household can sell

Table A-2 continued

Variables & Sources	Definitions
Value of crop land that can be sold (Question 7.1.8b)	Market value of crop land (in rand) that can be sold
Interest Income (Question 8.7.1)	Annual Interest earnings (in rand) from non-employment sources, including dividends and interest from savings and loans
d. Derivation of Hourly Wage	
Wage Rate (Sections 8.1.1, 8.2.3 & 8.2.4, pp. 27-33)	Wage rate (rand per hour) inclusive of taxes plus bonuses and subsidies for transport, food and housing (in Data File M6_REMP) See derivation below
Wage Earner (Question 3, p. 27)	Whether a person is currently employed (1 = regular wage employment including self-employed professionals and 0 = otherwise)
Hourly Wage	The regular hourly wage is that reported for a pay period, divided by our estimate of the hours worked in that period. The number of hours worked was approximated by multiplying the reported number of hours worked on an average day (k_hours) in M6-REMP by the days worked in the reported pay period (p_paytyp) which for one week is assumed to be 5.4, a fortnight is 10.8, and a month is 21.7. Bonuses, payments in kind, and subsidies are only reported on an annual basis and are divided by the approximate number of hours worked per year. The number of days worked per week of 5.4 is multiplied by 52 weeks and by the 8 hour workday to arrive at 2246 hours per year. The bonus hourly premium plus the hourly wage is the total hourly wage analyzed in this paper. The analysis was initially repeated using only the regular hourly wage, with no notable changes in the estimated schooling returns, implying that the proportion of bonuses to total wage is roughly constant across workers with different educational levels.

Table A-3

Two-stage Heckman Parameter Estimates of the Wage Function
(absolute values of t-ratios in parentheses)

Sample	African		Colored		Indian		White	
	Men	Women	Men	Women	Men	Women	Men	Women
Years of Primary Education	.082 (10.2)	.060 (5.79)	.027 (.64)	.024 (.64)	-.096 (2.59)	-.079 (1.63)	-.019 (.69)	-.110 (.29)
Years of Secondary Education	.172 (13.9)	.239 (13.5)	.170 (3.50)	.195 (2.13)	.212 (5.51)	.117 (1.64)	.094 (3.03)	.021 (.43)
Years of Higher Education	.331 (10.1)	.367 (8.33)	.164 (1.96)	.306 (4.11)	.210 (6.16)	.298 (4.67)	.153 (8.33)	.131 (6.23)
Job Experience ($x10^{-1}$)	.748 (7.85)	.361 (2.59)	.307 (.44)	.714 (1.14)	.947 (4.06)	.806 (3.98)	1.136 (5.92)	.370 (2.75)
Experience Squared ($x10^{-2}$)	-.104 (6.86)	-.044 (1.92)	.031 (.23)	-.130 (1.07)	-.149 (2.91)	-.135 (3.27)	-.212 (4.90)	-.056 (1.68)
Rural Area	-.468 (12.6)	-.318 (5.66)	-1.182 (4.56)	-1.053 (3.22)	.070 (.17)	.092 (.15)	-.319 (2.78)	-.209 (1.98)
Heckman Lambda	.262 (2.99)	-.121 (.95)	-.343 (.44)	-.037 (.06)	-.099 (.29)	-.053 (.17)	.173 (.69)	-.221 (.70)
Constant	-.218 (1.04)	.103 (.29)	1.371 (1.02)	.398 (.28)	1.324 (2.36)	1.371 (2.02)	1.593 (4.40)	2.436 (6.71)

Sample	Urban Areas				Rural Areas			
	African		White		African		White	
	Men	Women	Men	Women	Men	Women	Men	Women
Years of Primary Education	.034 (2.92)	.041 (2.79)	.006 (.22)	-.014 (.39)	.102 (9.31)	.067 (4.36)	.068 (.45)	-.401 (3.63)
Years of Secondary Education	.103 (3.43)	.172 (5.48)	.085 (2.69)	.026 (.60)	.203 (11.6)	.313 (11.9)	.084 (.59)	.370 (3.34)
Years of Higher Education	.230 (5.17)	.323 (4.57)	.151 (8.34)	.138 (7.04)	.352 (7.06)	.354 (5.19)	-.008 (.09)	.103 (1.40)
Job Experience ($x10^{-1}$)	.155 (.54)	.125 (.33)	.970 (4.27)	.419 (3.30)	.813 (7.51)	.495 (3.10)	1.999 (5.18)	.665 (2.54)
Experience Squared ($x10^{-2}$)	-.017 (.39)	-.011 (.19)	-.169 (3.33)	-.072 (2.31)	-.113 (6.42)	-.060 (2.25)	-.500 (5.31)	-.092 (1.58)
Heckman Lambda	-.262 (.95)	-.291 (.87)	.047 (.16)	-.070 (.26)	.246 (2.48)	-.067 (.47)	-.492 (1.17)	.076 (.27)
Constant	1.488 (2.15)	.884 (.95)	1.753 (4.11)	2.270 (7.41)	-.894 (3.71)	-.639 (1.49)	1.253 (1.44)	2.711 (3.05

Table A-4

Probit Estimates of the Participation Equation
(asymptotic absolute t-ratios in parentheses)

Explanatory Variables	African		Colored		Indian		White	
	Men	Women	Men	Women	Men	Women	Men	Women
a. Schooling and Experience								
Intercept	-1.912 (4.40)	-2.300 (5.68)	-1.581 (.01)	-1.334 (.02)	-.521 (.55)	-.457 (.54)	-1.940 (3.64)	-.830 (1.75)
Years of primary education	-.011 (1.37)	.021 (2.46)	-.069 (2.13)	-.052 (1.80)	-.011 (.19)	-.051 (.97)	-.051 (1.66)	-.145 (5.88)
Years of secondary education	.090 (8.19)	.109 (8.64)	.078 (2.53)	.190 (5.86)	.034 (.61)	.202 (3.60)	.065 (1.99)	.192 (6.78)
Years of higher education	.222 (6.36)	.358 (10.2)	.106 (1.33)	.061 (.68)	.073 (1.18)	.188 (1.88)	.025 (1.09)	.062 (2.28)
Potential job Experience in years (10^{-1})	1.202 (27.6)	1.257 (25.5)	1.297 (10.9)	1.298 (10.2)	.865 (4.94)	.522 (3.04)	1.036 (10.8)	.513 (5.63)
Potential job Experience squared (10^{-2})	-.180 (22.9)	-.197 (22.2)	-.241 (9.95)	-.247 (9.60)	-.185 (4.48)	-.103 (2.79)	-.233 (10.6)	-.130 (6.47)
b. Sample Clusters								
Sample cluster with tarred roads	.597 (11.2)	.282 (4.91)	.239 (2.22)	.180 (1.69)	-.252 (.94)	.377 (1.38)	-.094 (.75)	.116 (.95)
Sample cluster not reporting	-.126 (3.07)	.059 (1.35)	.250 (1.18)	.211 (1.05)	-	-	-.421 (1.93)	.074 (.35)
Rural Area	-.011 (.30)	-.242 (5.98)	.639 (3.36)	.808 (4.32)	4.093 (.07)	.771 (.79)	-.182 (1.12)	-.115 (.71)

Table A-4 continued

c. Wage Earner Identifiers								
Market value (in 1,000 rand) of nonfarm assets (x 10^{-2})	.586 (1.59)	.373 (1.05)	.295 (.14)	.014 (.97)	.250 (.54)	.931 (1.62)	.020 (48)	.036 (.62)
Does any person in the household receive rental income from nonfarm assets? (1=yes)	-.096 (.38)	-.180 (.74)	.369 (.81)	-.035 (.11)	1.252 (1.50)	1.284 (1.79)	-.481 (2.25)	-.237 (.98)
Rental income (in 1,000 rand) from nonfarm assets received over the past 12 months	-.202 (1.49)	-.053 (.55)	-.038 (.18)	.078 (.69)	-.363 (1.67)	-.330 (1.70)	.001 (.21)	-.014 (1.03)
Market value of equipment (in tens of rand) used in self-employment	1.078 (2.11)	46.46 (.08)	-.0212 (.80)	-.474 (.42)	3.799 (.06)	1.571 (.07)	.00004 (.32)	-.0003 (.39)
Does a household have a right to use land for crop farming? (1=yes)	-.518 (7.18)	-.486 (6.67)	-	-	4.261 (.04)	-3.719 (.08)	.191 (.47)	.133 (.41)
Hectares of land that cannot be sold (x10^{-2})	-.045 (1.70)	.198 (1.14)	-	-	-	-	-.146 (.95)	-.099 (.93)
Proportion of land that can be irrigated with available water	.361 (2.86)	.415 (3.05)	-	-	-	-	.240 (.57)	-.818 (1.87)
Does a household have a right to use land for stock farming? (1=yes)	-.467 (6.84)	-.292 (3.84)	4.768 (.04)	4.659 (.09)	-	-	-.430 (1.43)	-.256 (.91)
Does a household have a right to sell part of the land it uses for crop farming? (1=yes)	.205 (.60)	.421 (1.35)	-.472 (.01)	.666 (.01)	-	-	-.824 (1.91)	-.053 (.15)

Table A-4 continued

Hectares of crop land that a household can sell ($\times 10^{-2}$)	.251 (2.41)	.164 (1.42)	-	-	-	-	-.0077 (.49)	-.013 (.60)
Market value of land (in rand) that can be sold ($\times 10^{-5}$)	.621 (1.13)	.761 (1.60)	-	-	-	-	.546 (.89)	-.678 (.95)
Annual interest income (in rand) from nonfarm assets ($\times 10^{-2}$)	-.193 (1.77)	-.046 (.41)	-.414 (.07)	-.016 (.61)	.008 (.29)	.013 (.32)	-.00016 (1.51)	-.0002 (1.91)
Log-likelihood	-3664.5	-3584.2	-546.7	-567.3	-228.7	-209.2	-895.7	-899.3
Sample size	9325	10473	958	1075	363	411	1447	1517

Table A-4 continued

Urban and Rural Areas: Probit Estimates of the Participation Equation
(asymptotic absolute t-ratios in parentheses)

Explanatory Variables	Urban Areas				Rural Areas			
	African		White		African		White	
	Men	Women	Men	Women	Men	Women	Men	Women
a. Schooling and Experience								
Intercept	-2.590 (7.77)	-3.132 (9.43)	-1.634 (4.88)	-.914 (2.70)	-1.327 (2.10)	-2.018 (1.67)	-.819 (.37)	-1.136 (.00)
Years of primary education	.005 (.33)	.016 (1.12)	-.050 (1.57)	-.152 (5.92)	-.022 (2.31)	-.016 (1.49)	-.227 (1.28)	-.114 (.95)
Years of second ary education	.145 (8.27)	.106 (5.69)	.067 (1.98)	.185 (6.26)	.067 (4.58)	.109 (6.25)	.322 (2.10)	.376 (2.79)
Years of higher education	.165 (2.94)	.256 (4.93)	.019 (.78)	.062 (2.22)	.278 (6.20)	.444 (9.23)	.049 (.44)	.293 (2.00)
Potential job Experience in years (10^{-1})	1.504 (19.8)	1.505 (19.3)	1.069 (10.7)	.550 (5.70)	1.009 (18.6)	1.070 (16.7)	.777 (2.13)	.237 (.70)
Potential job Experience squared (10^{-2})	-.222 (15.9)	-.238 (16.5)	-.239 (10.4)	-.140 (6.54)	-.152 (15.8)	-.168 (14.9)	-.144 (1.83)	-.044 (.58)
b. Sample Clusters								
Sample cluster with tarred roads	.177 (2.68)	.295 (4.84)	.221 (1.54)	.215 (1.54)	-1.693 (14.6)	.230 (1.01)	-1.381 (3.57)	.442 (1.22)
Sample cluster not reporting	-.044 (.43)	.068 (.67)	.103 (.44)	.129 (.56)	-.100 (2.23)	-.070 (1.45)	-	1.744 (1.36)

Table A-4 continued

c. Wage Earner Identifiers								
Market value (in 1,000 rand) of nonfarm assets (x 10^{-2})	.777 (1.59)	.702 (1.48)	.023 (.48)	.096 (1.48)	-.156 (.24)	.099 (.17)	.118 (37)	.414 (1.16)
Does any person in the household receive rental income from nonfarm assets? (1=yes)	-.074 (.24)	-.344 (1.13)	-.661 (2.85)	-.330 (1.26)	.364 (.71)	.122 (.11)	-.188 (.18)	-.789 (.00)
Rental income (in 1,000 rand) from nonfarm assets received over the past 12 months	-.217 (1.31)	-.052 (.40)	-.001 (.11)	.022 (1.61)	-.072 (.46)	-1.297 (.36)	.208 (.51)	1.238 (.00)
Market value of equipment (in tens of rand) used in self-employment	1.048 (.09)	45.69 (.11)	.00006 (.49)	-.0002 (.39)	1.087 (2.07)	34.75 (.11)	.198 (1.64)	.874 (.01)
Does a household have a right to use land for crop farming? (1=yes)	.154 (.20)	-1.103 (1.14)	.310 (.56)	-.715 (1.19)	-.455 (6.28)	-.474 (6.53)	1.332 (1.52)	1.784 (2.46)
Hectares of land that cannot be sold ($x10^{-2}$)	-	-	-.210 (1.00)	.429 (1.39)	-.068 (2.47)	.322 (1.23)	.012 (1.93)	-.355 (1.67)
Proportion of land that can be irrigated with available water	-16.87 (.05)	1.696 (1.35)	1.216 (1.30)	.083 (.11)	.351 (2.77)	.359 (2.56)	-.810 (.91)	-1.965 (2.17)
Does a household have a right to use land for stock farming? (1=yes)	22.07 (.07)	.356 (.42)	-.082 (.21)	.622 (1.49)	-.474 (6.88)	-.297 (3.90)	-.609 (.91)	-.915 (1.37)
Does a household have a right to sell part of the land it uses for crop farming? (1=yes)	-	-	-	-	.069 (.19)	.399 (1.26)	1.181 (.76)	3.261 (2.17)
Hectares of crop land that a household can sell (x 10^{-2})	-	-	-	-	.256 (2.42)	.151 (1.33)	-.017 (1.67)	-.184 (1.55)
Market value of land (in rand) that can be sold (x 10^{-5})	-	-	-	-	.693 (1.27)	.761 (1.61)	29.74 (1.15)	-.314 (2.08)

Table A-4 continued

Annual interest income (in rand) from nonfarm assets ($x10^{-2}$)	-.004 (1.50)	.022 (.18)	-.023 (2.07)	-.026 (2.24)	.084 (.49)	-.365 (.94)	-.020 (19)	-.0048 (.55)
Log-likelihood	-3664.5	-1564.3	-822.9	-822.5	-2623	-1996	-48.3	-52.4
Sample size	9325	3394	1314	1380	6300	7079	133	137

Table A-5

Data Used in GLS Estimation of the Effect of Supply of Educational Skills on Wage Returns, Conditional on Age, Sex, and School Level*

Age Group & Sch Level	Return	Error	Age	Race	Sex	Grad	Some	Supply
African Women (16-29 years)								
Ed_P	.0078606	.0313009	1	1	0	.75	.92	.84
Ed_S	.2719096	.0262847	1	1	0	.31	.63	.47
Ed_H	.4842499	.0572728	1	1	0	.02	.12	.07
African Women (30-44)								
Ed_P	.0900387	.0175833	2	1	0	.68	.90	.79
Ed_S	.2181999	.0217060	2	1	0	.19	.55	.37
Ed_H	.3851409	.0464678	2	1	0	.02	.11	.07
African Women (45-65)								
Ed_P	.0618539	.0185944	3	1	0	.51	.77	.64
Ed_S	.3247717	.0362307	3	1	0	.08	.42	.25
Ed_H	.2171114	.0820213	3	1	0	.01	.05	.03
African Men (16-29)								
Ed_P	.1148317	.0221427	1	1	1	.65	.90	.78
Ed_S	.2122214	.0210796	1	1	1	.20	.53	.37
Ed_H	.3168407	.0537160	1	1	1	.03	.05	.04
African Men (30-44)								
Ed_P	.1036964	.0131851	2	1	1	.62	.87	.75
Ed_S	.1386165	.0164555	2	1	1	.16	.49	.33
Ed_H	.2899736	.0370602	2	1	1	.02	.05	.04
African Men (45-65)								
Ed_P	.0610668	.0159342	3	1	1	.42	.73	.58
Ed_S	.0844321	.0315645	3	1	1	.05	.32	.19
Ed_H	.1756228	.1143484	3	1	1	.00	.02	.01
Colored Women (16-29)								
Ed_P	.0568936	.0733749	1	2	0	.78	.96	.87
Ed_S	.1914843	.0523268	1	2	0	.34	.71	.53
Ed_H	.2695696	.1056355	1	2	0	.03	.05	.04
Colored Women (30-44)								
Ed_P	-.0236284	.0480377	2	2	0	.79	.96	.88
Ed_S	.2226320	.0515052	2	2	0	.11	.71	.41
Ed_H	.3649704	.1072007	2	2	0	.02	.07	.05
Colored Women (44-65)								
Ed_P	.2024290	.0497659	3	2	0	.64	.92	.78
Ed_S	.2229548	.0707415	3	2	0	.02	.46	.24
Ed_H	.		3	2	0	.00	.00	.00
Colored Men (16-29)								
Ed_P	-.0232633	.0577561	1	2	1	.80	.94	.87
Ed_S	.2421334	.0436372	1	2	1	.26	.77	.52
Ed_H	.1989737	.1253408	1	2	1	.02	.05	.04
Colored Men (30-44)								
Ed_P	.0126297	.0532488	2	2	1	.83	.96	.90
Ed_S	.1183438	.0449375	2	2	1	.16	.73	.45
Ed_H	.1528754	.0811100	2	2	1	.05	.06	.06
Colored Men (45-65)								
Ed_P	.0740816	.0828348	3	2	1	.75	.90	.83
Ed_S	.1156412	.0979423	3	2	1	.07	.65	.36
Ed_H	.076393	.2623527	3	2	1	.01	.03	.02
Indian Women (16-29)								
Ed_P	-.2927438	.1572965	1	3	0	.96	.96	.96
Ed_S	.3356897	.1543966	1	3	0	.81	.96	.89
Ed_H	.2396513	.0798189	1	3	0	.04	.13	.09

Indian Women (30-44)								
Ed_P	-.4513031	.1333819	2	3	0	.94	1.00	.97
Ed_S	.1752187	.0580112	2	3	0	.40	.89	.65
Ed_H	.2602799	.0683375	2	3	0	.13	.21	.17
Indian Women (45-65)								
Ed_P	.1009420	.1060174	3	3	0	.67	.83	.75
Ed_S	-.1431383	.2149432	3	3	0	.17	.42	.30
Ed_H	.3467909	.5224277	3	3	0	.00	.08	.04
Indian Men (16-29)								
Ed_P	-.0830269	.0722357	1	3	1	.94	.94	.94
Ed_S	.2699946	.0980544	1	3	1	.70	.94	.82
Ed_H	.2869986	.0480084	1	3	1	.17	.19	.18
Indian Men (30-44)								
Ed_P	-.1721848	.0864197	2	3	1	.96	.97	.97
Ed_S	.2492655	.0719666	2	3	1	.57	.96	.76
Ed_H	.139844	.0669076	2	3	1	.13	.13	.13
Indian Men (45-65)								
Ed_P	.1646233	.0998553	3	3	1	.93	1.00	.97
Ed_S	.2138305	.0538896	3	3	1	.22	.85	.54
Ed_H	.1640501	.0576412	3	3	1	.10	.15	.13
White Women (16-29)								
Ed_P	.0847452	.0512576	1	4	0	.89	.91	.90
Ed_S	.0228831	.0425241	1	4	0	.78	.88	.83
Ed_H	.1530193	.0283114	1	4	0	.23	.30	.27
White Women (30-44)								
Ed_P	-.0362314	.0323596	2	4	0	.87	.91	.89
Ed_S	.0722329	.0347005	2	4	0	.63	.85	.74
Ed_H	.1220609	.0330572	2	4	0	.22	.33	.28
White Women (45-65)								
Ed_P	-.1034266	.0371174	3	4	0	.86	.91	.89
Ed_S	.1046465	.0438960	3	4	0	.53	.85	.69
Ed_H	.1330454	.0373613	3	4	0	.15	.25	.20
White Men (16-29)								
Ed_P	-.0780220	.0592200	1	4	1	.91	.94	.93
Ed_S	.1961911	.0497315	1	4	1	.71	.91	.81
Ed_H	.1766907	.0284313	1	4	1	.33	.36	.35
White Men (30-44)								
Ed_P	-.0021823	.0441670	2	4	1	.94	.96	.95
Ed_S	-.0153781	.0397308	2	4	1	.72	.94	.83
Ed_H	.1422709	.0294977	2	4	1	.40	.44	.42
White Men (45-65)								
Ed_P	-.2048347	.0516896	3	4	1	.95	.96	.96
Ed_S	.1486949	.0589302	3	4	1	.63	.95	.79
Ed_H	.0887096	.0391527	3	4	1	.33	.34	.34

*Ed_P, Ed_S, Ed_H = Years of Education at three School Levels (P=Primary, S=Secondary and H=Higher);
Return = Ordinary Least Squares Estimate of the Rate of Return to a Year of Education in a Particular School Level;
Error = Standard Error of the Rate of Return to Schooling;
Age = Age Groups (1=16-29 years, 2=30-44 years, 3=45-65 years);
Race = Population Groups (1=African, 2=Colored, 3=Indian, 4=White);
Sex = Sex of age-race Group (1=Male, 0=Female);
Grad = Proportion of the Age Group having Graduated from a School Level (i.e., Primary > 6, Secondary > 4, Higher > 2);
Some = Proportion of the Age Group Attending a Particular School Level at the Time of Sample Survey;
Supply = (Grad + Some)/2 (Average of Proportions of Age Groups having Graduated from or having Attended a Particular School Level).

APPENDIX B

REGRESSION DECOMPOSITION OF WAGE GAPS BETWEEN GROUPS

This appendix illustrates how differences in wages among groups of workers can be accounted for by group differences in observed productive characteristics, based on their valuation from within-group wage regressions. The objective is to estimate the portion of a intergroup wage differential that is attributable to differences in worker reproducible characteristics that public policy might be able to modify, as in the case of bringing the educational attainment of one lower-wage group up to the educational attainment of a higher-wage group. We use the Oaxaca (1973) method to decompose the wage gap into the share that is "explained" by each of several characteristics and the "residual" or unexplained share. In the text (Table 5) this decomposition is reported for three nonwhite racial groups compared with the white group within both the male and female subpopulations of wage earners, for three characteristics: education, postschooling years of experience, and residential location.

First, the logarithms of hourly wages of workers, W, are estimated as a linear function of k observable worker characteristics, X_k, where subscripts j refer to African (a), colored (c), Indian (i) or white (w) races within either the male or female subpopulations of wage earners, where the subscript for the individual in the sample survey is suppressed for simplicity:

$$W_j = \alpha_j + \Sigma \beta_{jk} X_{jk} + \epsilon_j, \quad j = a, c, i, w, \tag{B-1}$$

where α's are the intercepts and β's the coefficients on the worker characteristics estimated by either Ordinary Least Squares, if the errors, ϵ, are orthogonal to the individuals probability of inclusion in the wage earner sample, or if errors are not orthogonal by a sample selection model that includes Lambda, the inverse of the Mills ratio, a nonlinear function of the probability that the individual is a wage earner (Heckman, 1979).

In the linear model, differences between the logarithms of the wages of any two groups of workers, say a and w, where the errors average out, can be rearranged and rewritten as:

$$W_w - W_a = (\alpha_w - \alpha_a) + (\Sigma\, \beta_{ak}(X_{wk}-X_{ak})) + (\Sigma\, X_{wk}(\beta_{wk}-\beta_{ak})) \qquad \text{(B-2)}$$

The middle terms on the right-hand side express the difference in the log wages that is explained by the difference in worker characteristics valued by the estimated regression coefficient for that characteristic estimated within the African population, whereas the first and third terms are for our purposes unexplained differences or the residual in group wage differences.

The decomposition of wage differences can equally well be expressed as differences in the worker characteristics weighted by the regression coefficients from the white regression, β_w, where the residual would contain the differences in the regression coefficients weighted by the African characteristics, X_a. In the case of South Africa, where the African racial group represents three-fourths of the population, it seems a priori more reasonable to use the first decomposition that emphasizes the labor market regression weights of the African majority, rather than those of the white minority. However, when it comes to evaluating the returns on higher education the same logic might suggest that the white minority represents a larger segment of the educated labor force than the white population overall share would suggest. The point of the regression decomposition exercise is that there is uncertainty on the role of the worker characteristics in explaining the wage differences if the regression weights differ between the comparisons groups, or in this case as long as $\beta_a \neq \beta_w$. This will generally be true or it would be justifiable to aggregate the two groups in a single wage regression and only allow for intercepts to differ between the groups. Other decompositions of group differences in wages are also possible, such as those that are based on wage rates rather than logarithms of wage rates (Cain, 1986, p. 746). But because the analysis of this paper is directed to understanding the

dependent variable of the logarithmic wage rate, the specification of the wage gap in terms of the logarithmic form appears more appropriate here.