Perceptions and Signals:
Education reform and its impact on labour market outcomes in the new South Africa

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Abstract

Education plays a key role in labour market outcomes. It increases worker productivity and serves as an important signal to employers of potential employee ability. This signalling function is important given that interaction in the labour market is typified by asymmetric information. This information problem is aggravated in South African by the unequal provision of, and access to, educational resources and labour market opportunities during apartheid. This paper posits that post-apartheid education reforms, which were ostensibly intended to rectify these imbalances, have had adverse effects on the prospects of individuals entering the labour force. Specifically, there has been a clear, negative impact on employer perceptions towards qualifications produced by the education system, especially for a school-leaving matriculation certificate. Using job market signalling theory and econometric analysis of cross-sectional data from Labour Force Surveys, this paper investigates the changes in these employer perceptions and their corresponding impact on labour market outcomes. At a disaggregated level, the data indicate that the signalling quality of education qualifications has changed in a distinct manner. Whilst a matriculation certificate has improved the employment prospects of qualification-holders, the returns for newly-qualified matriculants have fallen substantially relative to their predecessors. Conversely, newly-qualified individuals from tertiary institutions have seen sharp rises in their earnings and persistently higher probabilities of finding employment. These findings highlight the fractious nature of the South African labour market, and the severe impact that changes in education signals can have on employment outcomes. Furthermore, they reinforce previous literature on the potentially perverse incentives that exist for further educational attainment in South Africa.

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1 INTRODUCTION

By far one of the most deleterious and enduring legacies of the apartheid system is the deliberately unequal provision of education to different population groups. Historically, white schools were favoured over black schools, in terms of both resources and finances. Not only was there a clear ranking of different racial groups, but there was a systematic failure under colonialism and apartheid to invest in black education and thus develop the black workforce.

Since 1994, in an attempt to rectify these past inequalities, the government has pledged substantial funding from the fiscus to rebalance and equalise the provision of education to all racial groups. This funding has been matched on the policy-side with an overhaul of the education system. The government has sought to reform both the basic (primary and secondary) and tertiary education sectors. Undoubtedly the boldest reform by the new government has been the introduction of the National Qualifications Framework (NQF), a structure set up to co-ordinate the fragmented education and training systems in the country (Soudien and Baxen, 1997). To facilitate this ideological and pedagogical reform, the national Department of Education sought to introduce an outcomes-based system for basic education, more accurately Outcomes-Based Education (OBE), which replaced the preceding Senior Certificate.[3] The reform of the basic education sector has been coupled with the restructuring of higher education institutions in South Africa. Under the National Plan for Higher Education, the number of tertiary institutions were reduced from 36 to 22 through mergers of different institutions, beginning in 2002 (Ministry of Education, 2001).

The substantial transformation of the education system in post-apartheid South Africa has been met with harsh criticisms, both from the media (more recently, Pretorius [2008], Olivier [2009], and MacFarlane [2010]) and academics (see, for instance, Vithal [1997] and Jansen [1998, 1999]). This is especially true of OBE. Recent steps taken by the national Department of Basic Education to revise the OBE system gives some validity to these criticisms.[4]

[3]Initially dubbed 'Curriculum 2005', referring to the fact that the first class of school-leavers matriculating under the OBE system would be in 2005. Problems surrounding the implementation and resources available to schools eventually meant that the first matriculation exams under the OBE system were sat in 2008 (Fredericks, 2010).

[4]Criticism of the OBE style of learning and teaching is not only prevalent in South Africa. Globally, numerous critiques have been compiled, notably Schwartz and Cavener (1994) and Brady (1996).

This criticism of, opposition to, and recent backtrack on, education policy has undoubtedly had an effect on employer perceptions of the educational qualifications generated by such a system. These changes in perception should be seen in the light of the effect of post-1994 education on the employment probabilities of a particular individual and, given employment, the wage that such an individual can expect to earn. Importantly, such an analysis highlights two key points regarding the role of educational qualifications in post-apartheid South Africa. The first is that these qualifications should provide labour market participants with skills that enhance their productivity and thus saleable skills to employers. Secondly, the attainment of these qualifications must be perceived by employers as sufficiently difficult in order to create the impression that the attainment of such qualifications is a credible signal of participant productivity.

This paper attempts to add to the literature by analysing the signalling quality of educational qualifications over time and the effect these have on earnings and employment probability, and how these effects change over time. This idea is based on Spence's (1973) theoretical paper *Job Market Signalling*. It explores the notion that an educational qualification gives a signal to employers regarding the ability and associated productivity of the applicant. This is laid out with a brief examination of the evidence of returns to education, globally and in South Africa. A cursory theoretical explanation is then given on why perceptions and signals matter for labour market outcomes, with subsequent analysis of empirical data from post-apartheid labour market surveys. Importantly, a signalling framework to evaluate changes in earnings is developed. The paper concludes with some qualifications of the inherent biases of conducting such research and highlights the key findings of the investigation.

2 WHY EDUCATION MATTERS

Education plays a key role in labour markets. Card (1999) indicates that numerous studies in different countries and time periods demonstrate that individuals with higher educational qualifications earn higher wages, experience less unemployment, and work in more prestigious occupations than their less-educated counterparts. Similarly, Psacharopoulos and Patrinos (2002) reaffirm the importance of education in their investigation into the returns to investment in education over the past 40 years. Overall, they find the average return for schooling across countries to be 9.7%, with the highest returns recorded for low- and middle-income countries (of which South Africa is one). Their cross-country analysis, with evidence and estimates from econometric techniques, demonstrates falling returns to education by level of economic development and by level of education. This is to say that

there is concavity in the returns structure for education.

In contrast, substantial evidence exists to suggest that, instead, convexity in returns to education exists in both developed and developing countries. In their paper, Keswell and Poswell (2004) note that the findings for South Africa are no different, despite difficulties experienced in data representivity and differing methodologies.[5] Keswell and Poswell (2004) go on to demonstrate in their paper that there is no support for concavity in return structure for South Africa as documented by Psacharopoulos (1973, 1985, 1994) and Psacharopoulos and Patrinos (2002). In fact, they find strong evidence of a convex relationship between education and earnings in South Africa. This implies that rates of return increase with higher levels of education, especially tertiary education. However, while the marginal return for tertiary education is extremely high, it is low and approaching zero for lower levels of schooling. The non-Mincerian approach finds that the majority of surplus labour in South Africa is found amongst low education levels - this contributes to the strong form of convexity observed. Additionally, for South Africa, a substantial portion of this convexity relates to race. Evidence suggests that whilst whites are rewarded equally by level of education, the returns to education for blacks remain are distinctly convex (Keswell, 2004).

Table 1: Returns to Education: Selective Evidence

	Psacharopoulos and Patrinos (2002)	Lam (1993)	Keswell and Poswell (2004)
Returns to education *Global*	9.7	-	-
Mean years of schooling *Global*	8.3	-	-
Returns to education *Brazil*	14.7	14.3^	-
Mean years of schooling *Brazil*	5.3	5.8	-
Returns to education *South Africa*	4.1	-	11
Mean years of schooling *South Africa*	7.1	8.1	8.5

Interestingly, both Keswell (2004) and Keswell and Poswell (2004) stress that, assuming standard models of human capital accumulation such as Mincer (1974), Becker (1964) and Card (2001) are accurate, the convex

[5]Unrepresentative (non-random) samples of the population during Apartheid, and vastly different methods of calculating returns make comparisons of South African studies difficult.

returns structure to education seen in South Africa may create perverse incentives that do not promote the attainment of further schooling. In other words, individuals will tend to obtain less education as they are unlikely to see the benefit of staying in school, as this will not yield higher wages.

3 EDUCATION QUALIFICATIONS AND JOB MARKET SIGNALLING

In his seminal paper, Spence (1973) asserts that in the labour market the employer is unaware of the productive capabilities of an employee until he hires the applicant. On the basis of previous involvement in the labour market, employers will have conditional probability assessments of employee productivity, given a combination of *indices* and *signals* sent out by the applicant.[6] For a risk-neutral employer, this will be the marginal product of the employee. Now, the employer cannot perceive the marginal product prior to hiring - all he has are observable characteristics - so the marginal product is based on these conditional probabilities from past labour market interactions. After hiring the individual, the employer becomes aware of the productivity characteristics and adjusts his conditional probability assessment accordingly for subsequent interactions in the labour market.

Importantly, these signals sent out by applicants to employers are alterable. Given certain conditional probability assessments by employers, potential employees may choose to alter their signals so as to firstly, gain employment, and secondly, receive a higher wage. These signal alterations, however, come at a cost. In the research done in this paper, the focus is on education, which is, of course, costly. These costs include the direct monetary costs, psychic costs (of studying and hard work), and the opportunity cost of education. Worth noting here is that the individual, when investing in education, need not think of obtaining the qualification as signalling. Instead, the investment is made if there is sufficient return as defined by the offered wage schedule.

For an education signal to be credible and have some quality to an employer, the signalling costs must be negatively correlated with productive capability. In other words, the higher the signal costs, the more capable an individual must be, else everyone would invest in the signal.

Under Spence's model, education need not add to the productivity of an individual at all. Instead, education may be a prerequisite for the individual to enter the labour market. It is productive for the individual to

[6] *Indices* are defined by Spence (1973) as observable, unalterable characteristics of an employee (for example, race or sex). *Signals*, on the other hand, are observable but can be manipulated by applicants. Chief amongst interest here are education qualifications.

acquire it (as he has a chance of gaining employment) but it does not increase his marginal product at all. Investment in education can thus be seen as rational, whether one assumes it is productivity-enhancing or not. If the individual did not invest in education, there would be losses through lower wages, and these losses may outweigh the benefits of not making the educational investment.

Importantly, Spence (1973:357) states that primary interest for research into labour market signalling lies in how employers perceive applicants, as "it is these perceptions that determine the wages [the employer] offers to pay". As it is the perceptions that form the basis for the employment decision, as well as the notional wages paid to employees, changes in these perceptions must surely be reflected through changes in wages, *ceteris paribus*.

Indeed, there is evidence that employers have distinctly negative perceptions regarding the quality of education in post-apartheid South Africa. Altman and Marock (2008:16) find that as a result of these negative perceptions, employers have "ratchet[ed] up the minimum requirement for any particular job, in order to ensure that applicants have basic literacy and numeracy skills in place". Furthermore, Bhorat, Mayet and Visser (2010) find that there are perceptible differences in the way employers treat tertiary graduates from historically white institutions versus those from historically black institutions (with regard to both the employment decision and wage levels).

Put differently, one could postulate that the quality of the signal offered by post-apartheid educational qualifications may have declined in the view of employers. These changes in employer perceptions may reflect through changes in the wages offered to the holders of such qualifications. It is this theoretical relationship, as espoused by Spence (1973), that will be empirically tested in this paper.

There are several potential factors at play in generating these changes in perceptions. Changes in the perceptions, as discussed, would filter through to a change in the wages, as well as probability of finding employment, given the qualification the individual has. It is in this context that each of the following factors should be framed.

Firstly, the quality of the educational qualification in question undoubtedly plays a major role in determining employer perceptions. A perceived decline in the quality of the educational qualification will directly impact on the perceptions of employers. This must therefore form the broadest category, impacting on, and inextricably linked to, the remaining factors mentioned below.

Secondly, there is the quality of the material taught. The quality of the qualification itself does not only stem from the material itself but the applicability of the material taught to the real economy and the skills it inculcates in school-leavers. More than this though, there is a danger that either (or both) the Senior Certificate or the OBE systems have not been adequately preparing school-leavers with skills that the job market requires. Indeed, this appears to be attested to by the findings of Altman and Marock (2008).

Thirdly, there may be a perceptible impact of the difficulty of attaining the qualification on the signal the qualification sends. This, somewhat similarly to the qualification, is inextricably linked across the other factors.

Lastly, the role of uncertainty also has an effect on employer perceptions. Neoclassical theory accepts that economic agents make optimal decisions under certainty. It is plausible that a degree of uncertainty exists in employers' minds around this restructuring of the education system (at primary, secondary and tertiary level). If anything, the work of Altman and Marock (2008) highlights this. In addition, Jansen (1999) argues that the introduction of OBE is more a political and ideological response than a response to learning needs. The ideology behind the restructuring is therefore likely to have an impact on perceptions. Under Spence's (1973) model, employers will find it more difficult to distinguish between workers of high productivity and those of low productivity if there is uncertainty over how good a signalling instrument the qualification is.

All of these above factors filter in to the perceptions and decision making of employers. Whilst the reader may find that some of the above points argue more in favour of a human capital theory approach to education, rather than as a signalling device, this is in fact a misconception, as the two are not mutually exclusive. Whilst the models originally proposed by Spence (1973) appear to ignore the notion that education enhances productivity, later clarification and more expansive models explain that productivity enhancements *are* permissible (Spence, 2002).

In light of these points, this paper aims to examine whether the impact of educational qualifications on earnings potential and the probability of finding a job has changed over time for labour market participants. At the apex of the basic education system is the matriculation certificate. The focus of this paper will therefore rest on investigating the changes in the earnings and employment functions given a matric certificate. To a lesser extent, reference will also be given to tertiary qualifications. The reason for this focus is because it these qualifications that are arguably most affected by educational reform in South Africa, and therefore provide focal points for analysing changes in labour market outcomes.

4 DATA

To investigate the educational reward landscape in South Africa, this paper uses cross-sectional data from the representative Labour Force Survey (LFS) conducted by Statistics South Africa. Specifically, this paper uses the September waves of the LFS for 2000 and 2007, weighted relative to the population.Ideally, the most recent LFS should be used. The replacement of the previous Senior Certificate with the OBE-oriented National Senior Certificate as a school-leaving examination only occurred in 2008, a year after the second snapshot of data used here was taken. LFSs later than 2008 could not be used as Statistics SA dropped the income question from the 2008 survey onwards. Despite the fact that the actual OBE matriculation certificate will not be tested for, the hypothesis of employer perceptions changing over time can still be tested, given that this should effect all 'graduates' since the fall of apartheid. Tables 2 to 4 below outline the details of the data used in this paper.

Table 2: Sample Characteristics of Surveys Used

Description	LFS 2000				LFS 2007			
	Sample Size	% of sample	Mean age	Mean schooling	Sample Size	% of sample	Mean age	Mean schooling
Unemployed	14 807	47.47	30.62	8.43	16 151	51.78	30.74	8.77
Employed	16 383	52.53	37.74	8.35	13 610	43.64	37.94	8.80
Black	24 990	80.12	34.22	8.11	23 898	76.62	33.78	8.70
Coloured	3 893	12.48	33.80	8.06	4 443	14.24	34.31	8.27
Indian/Asian	667	2.14	35.31	11.27	481	1.54	35.65	11.29
White	1 640	5.26	37.44	12.18	939	3.01	38.31	11.92
Male	15 810	50.69	34.91	8.19	14 254	45.70	34.44	8.56
Female	15 380	49.31	33.80	8.59	15 507	49.72	33.66	8.99
n	31 190	-	34.36	8.38	29 761	-	34.03	8.78

At a glance, Table 2 shows some interesting features of the data. One observation is that the mean education levels for the unemployed only differ slightly from the employed. Investigating this further, it can be seen, however, that there is a substantial difference in the mean age of the employed and unemployed. On average, the unemployed are almost seven years younger than the employed. This provides indications of the difficulties facing the youth in finding employment relative to older cohorts, a phenomenon that is well documented in South Africa (see, for instance, Altman [2007] or Branson [2005]). This age gap does not change between the two surveys, indicating that this is a persistent feature of the data over time.

Differences in educational attainment between races are also obvious. Whilst the Indian/Asian and white race groups have a mean education level of approximately a matric certificate, the black and coloured groups have, on average, only slightly more than a grade 8 level of education (although this does rise between the two data periods, especially for the black race group).

Table 3: Sample Characteristics of the Employed

Description	LFS 2000						LFS 2007					
	Sample size	%	Mean schooling	Mean wage	Matric (%)	Tertiary (%)	Sample size	%	Mean schooling	Mean wage	Matric (%)	Tertiary (%)
Black	11 864	72.42	7.84	1486.24	15.64	9.97	10 019	61.15	8.60	1655.14	21.13	10.86
Coloured	2 611	15.94	7.91	1636.42	16.78	6.47	2 527	15.42	8.24	1723.20	20.62	6.02
Indian/Asian	503	3.07	11.43	3909.79	39.17	24.06	323	1.97	11.48	3969.40	50.46	17.65
White	1 405	8.58	12.37	6563.06	38.58	39.93	741	4.52	12.13	5761.22	42.65	34.14
Male	9 471	57.81	8.11	2053.44	18.80	9.75	7 720	47.12	8.55	2069.88	22.51	8.64
Female	6 912	42.19	8.68	1436.68	18.10	16.07	5 890	35.95	9.12	1541.85	23.41	14.99
n	16 383	-	8.35	1766.18	18.51	12.42	13 610	-	8.80	1822.18	22.90	11.39

Table 3 further interrogates the features of the employed. in the data sets who are employed and reported an income. Firstly, there is a strictly higher proportion of employed individuals with a matric in 2007 than there are in 2000. By race, all three of the previously disadvantaged groups experienced large increases, with increases for the black, coloured, and Indian/Asian race groups at 35.1%, 22.9%, and 28.8% respectively. These gains are associated with a broad increase in mean education levels across the two periods.

Table 4: Sample Characteristics of Educational Attainments

Description	LFS 2000				LFS 2007			
	n	% of sample	Mean age	Mean wage*	n	% of sample	Mean age	Mean wage*
No education	2 440	7.82	43.01	807.96	1 826	6.14	44.92	955.25
Primary School	8 911	28.57	36.81	1038.22	7 360	24.73	38.02	1155.32
Secondary School	10 950	35.11	32.94	1634.44	11 524	38.72	31.83	1566.18
Matric	6 292	20.17	29.65	2849.39	7 023	23.60	30.06	2509.47
Tertiary**	2 597	8.33	35.19	6378.60	2 028	6.81	35.99	6175.89
n	31 190	-	34.36	1766.18	29 761	-	34.03	1822.18

Note: Monthly wage (2007 constant prices) for full-time wage earners; Tertiary qualifications include diplomas, degrees, and certificates.

Finally, Table 4 analyses the educational composition of the data over the two surveys. There has been a general shift up and along the educational distribution (except for a slight fall in those with tertiary qualifications). This is evidenced by the shrinking proportions of those who possess no, or little education, and corresponding increases in those who possess partial or complete secondary schooling.

5 METHODOLOGY

To interrogate the data in a more substantive manner, this paper begins by specifying the standard log-level Mincerian wage function:

$$\ln wage = \ln a + \beta educ$$

Here, there is simply an intercept and the explanatory variable 'education', as specified by Mincer (1974). This is conventionally augmented with 'potential experience'.[7] In this paper, 'age' is used as a proxy variable for experience, as Keswell (2004) finds that 'potential experience' will be overestimated given the grade repetition and long spells of unemployment that typify the experience of the average South African labour market participant.

To allow for the convexity of returns in South Africa, as shown by Keswell and Poswell (2004), a wage function with education included as a quadratic term is also specified. Additionally, a quadratic term for age is used to capture the traditionally concavity associated with this. This augmentation yields:

$$\ln wage = \ln a + \beta_1 educ + \beta_2 educ^2 + \beta_3 age + \beta_4 age^2 \quad (1)$$

This equation is specified as the first model of interest, model (1). A model is also specified to determine the return to education for South African workers when controlling for race, gender, and province:

[7] Where "potential experience" is conventionally proxied by the formula: Age - Years of Education - 6 (Mincer, 1974).

$$\begin{aligned}\ln wage = \ln a &+ \beta_1 educ + \beta_2 educ^2 + \beta_3 age + \beta_4 age^2 \\ &+ \sum_{j=1}^{2} \Omega gender + \sum_{j=1}^{4} \Delta race \\ &+ \sum_{j=1}^{9} \sigma province \end{aligned} \tag{2}$$

Whilst the models in (1) and (2) are standard methods used to measure returns to education, the paper presented here is concerned with examining the returns to specific education levels. This analysis is done through dummy variables for various levels of educational attainment.
This gives rise to a third model, where variables controlling for gender, race, and province are again used:

$$\begin{aligned}\ln wage &= \ln a + \beta_1 age + \beta_2 age^2 \\ &+ \sum_{j=1}^{5} \delta education\ qualification \\ &+ control\ variables \end{aligned} \tag{3}$$

Where, in (3), the education dummy variables refer to a maximum attainment of partial or complete primary schooling, partial secondary schooling, a matriculation certificate, or a tertiary qualification. The 'tertiary' dummy variable here refers to a variety of tertiary qualifications. These are graduate degrees, post-matric diplomas/certificates, post-graduate degrees/diplomas, and certificates and diplomas received without the completion of a matric certificate.

5.1 A discussion of omitted variable bias

Unfortunately, potential biases may affect the results of this paper, as they inherently plague any estimate of the rates of return to education. These biases primarily stem from the omission of variables on ability, family background, and school quality (this is especially important given the educational history of South Africa), as well as mis-measurement of the schooling level.

For the omission of ability, a positive correlation between ability and level of education attained (individuals with greater ability will usually attain more education) will cause an upward bias on the OLS estimates on rate of return to education. Previous empirical attempts made to control for ability

have had fairly mixed results. Key amongst these attempts have included controlling for ability through the use of twins, who are presumed to have the same ability as a result of their similar genetics, done by Ashenfelter and Rouse (2000) and Bowles and Gintis (2002). Ashenfelter and Rouse (2000) find that the failure to control for ability imparts only a small upward bias on conventional estimates of the rate of return to education. Additionally, the use of IQ has been touted as a potential control variable for ability. Moll (1998), however, shows that the inclusion of cognitive skill as a proxy for ability will not dramatically affect the convex nature of returns. Lastly, Card (2001) reaffirms Griliches' (1970) conclusion that the effect of ability on returns to education (in the form of omitted variable bias) does not exceed 10% of the education coefficient.

The effect of omitting family background variables is less certain, given that certain of the variables cause bias in opposing directions. Card's (1999) review of available literature on returns to education suggests that the inclusion of controls on family background (such as a proxy on family member education) are just as likely to bias estimates as the wholesale omission of family background variables altogether.

The omission of a school quality variable is likely to bias the estimated returns to education given the high correlation between the quality of education attained and earnings (Card and Krueger, 1999). However, the choice of proxy variable for school quality has differing effects on return estimates. While Schultz (1988) and Card and Krueger (1999), demonstrate that the use of test scores or school grades as a proxy makes little difference to returns, Behrman and Birdsall (1983) show that an alternative proxy of a teacher-pupil ratio suggests that omission of school quality causes significant biases in return estimation.

While omitting ability, family background and school quality will tend to bias upwards, measurement error on reporting education level is likely to bias downwards. Despite a large amount of international literature on these biases, there is limited evidence for South Africa. Studies from developed countries, however, points towards these biases as having little net effect. This is substantiated in general by Griliches (1977) and Card (2001), and for South Africa in particular by Moll (1998). As a result, this paper makes no attempt to correct for these biases, chiefly due to the lack of data available in order to do so.

5.2 Formulating the dependent variable

5.2.1 Monthly salary

For the dependent variable, the natural logarithmic transformation of real monthly salary (in 2007 CPI-adjusted prices) is used. Observations with a monthly income above R300 000 (in 2007 prices) are classed as outliers and excluded. Whilst this covers only a small number of observations, they appear potentially erroneous and would likely skew the data.

Dependent variable observations used are income earners and the unemployed between the ages of 15 and 65.[8] Self-employed individuals are excluded from the data set. This is primarily due to the fact that the model used here will account for education as a signalling device to employers. Self-employed individuals thus do not fit into the model as relevant observations. In a similar vein, part-time employees are also excluded.

This paper broadly follows Deaton (1997), Keswell and Poswell (2004), and others, who advocate the inclusion of zero-income earners in regression models. In defining unemployment,the broad definition which includes 'discouraged' workers is used. Under the signalling framework that is developed later in the paper, these zero-income earners are no longer included.

Whilst OLS may provide a good approximation for the models specified, there is the danger that the unemployed observations (with zero income) may generate negative fitted values when using OLS. This is clearly incorrect when one is dealing with a non-negative function like wages. In light of this, Tobit regressions are also run on the three models specified above. This approach 'censors' at the zero value, dealing well with non-negative items that pile up at zero (Wooldridge, 2009), like the unemployed in earnings functions.

5.2.2 The problem of missing data

Whilst the exogenous sample selection of the labour force by age does not cause any bias or inconsistency in OLS, there is a danger that the problem of non-random missing data does. Namely, the feature of income non-response in the LFS data sets poses a problem, as it may be the case that non-response is systematically related to education level. Given the interest this

[8]Limiting the sample to between the ages of 15 to 65 years is an instance of exogenous sample selection and does not cause any bias or inconsistency in OLS. More formally, this non-random sample is unbiased as the regression of E(wage—age, education, race, gender) is the same for any subset of the population described by age, education, race, or gender (Wooldridge, 2009:323).

paper places on analysing the effect of education on wages, it is important to determine if a relationship exists between non-reporting of incomes and education. Ideally, one would want there to be no systematic relationship.

Testing for systemic relationships between missing and non-missing data is, however, somewhat of a grey area. Keswell and Poswell (2004) find that there is no systematic relationship between education level and income non-response, however it is not stated how they establish this. Allison (2001) gives a good overview of the cases of missing data and how one can deal with them. Briefly, these are missing completely at random (MCAR), missing at random (MAR), and not missing at random (NMAR). It is this last case that is of greatest concern when conducting statistical investigations.

To determine whether a statistically significant relationship exists between income non-response and education, this paper tests on three broad levels, namely mean-comparison testing, tests for the equality of distribution, and the correlation coefficients between the data. From the tests conducted, it appears that there does not exist a definite randomness between the response of individuals to the income question in the LFS and their level of education.

However, Allison (2001) states that correctly specifying a model for a variable that has data that is NMAR is difficult and that choosing the right model requires accurate and detailed knowledge of the phenomenon under investigation. The only generally used model for this type of data correction is the Heckman (1976) model for sample selection bias, more commonly known as the 'Heckit' method (Wooldridge, 2009). The Heckit method, however, requires that the probit and OLS regressions utilise different regressors (more precisely, that the regressors used in the OLS regressions are a subset of those used in the probit model). Given this constraint, the data used in this paper does not adequately provide for the development of such a model. It is for this reason that the assumption is made that the data is, in fact, missing at random and that listwise deletion is an appropriate mechanism for dealing with these missing observations.[9]

5.2.3 Employment status

The effect of education has not only been documented as having an effect on wages, but also on the probability of securing employment. Thus, it is necessary to specify models that account for the effect of education on employment status. Importantly, the dependent variable is dichotomous,

[9]Listwise deletion is removal from the sample of the those observations that have missing data on any variables that are used in the prediction of the model. Statistical packages automatically generate models with listwise deletion taken into account (Allison, 2001).

indicating the individual is either employed or unemployed. Again, unemployment in this paper is defined under the broad definition. Therefore, the employment models are defined as above, with the dependent variable changing to employment status (see Appendix A1).

6 RESULTS

6.1 Returns to Education - OLS and Tobit Estimations

The results of the OLS and Tobit regressions (shown in Table 6 and 7 respectively) provide for interesting analysis. Both methods display the classic concave returns structure for experience (proxied by age in this paper), and the convexity of education returns as illustrated by Keswell and Poswell (2004). Strikingly, this convexity persists sharply between 2000 and 2007. In the OLS model (2), the coefficient on years of education decreases from -0.23 to -0.33 and the coefficient on the quadratic term increases from 0.026 to 0.034, indicating an increase in slope. The same phenomenon is shown with the Tobit method, in similar contrast. The persistence of this phenomenon is evident, as in all of the models run for both OLS and Tobit, the convexity of returns is significant at the 1% level.

As expected, there are distinct differences in wages earned by race and gender. Females, on average, earn half as much as males, even when controlling for the level of education. The black, coloured, and Indian/Asian race groups experience similar differences relative to the white race group. Importantly, however, there is a visible decline in the wage differentials for females, blacks and Indians/Asians. Conversely, the wage differential for coloureds relative to whites rises over the seven years. Again, this is present in both the OLS and Tobit approaches.

Using OLS model (2), in 2000, the return to holding a matric certificate was precisely 46.7%, whereas this rises to 62.7% in 2007. Likewise, using Tobit model (2), the return rises between these two periods, with a return in 2000 of 45.8% to a return in 2007 of 57.4%.[10]

Whilst this may suggest increasing returns to a matric certificate over time, a simple linear approximation such as this may mask what is generating this change. It could be that years in addition to a matric are pulling general returns up or that returns to lower levels of education are falling. With this in mind, model (3) is run for each sample of data. This model serves to isolate the effects of a matric certificate on earnings.

[10]To calculate these figures exactly, the exponent of the natural logarithm is taken.

Table 5: OLS Regression Results

	LFS 2000			LFS 2007		
	OLS (1)	OLS (2)	OLS (3)	OLS (1)	OLS (2)	OLS (3)
Constant	-5.7618 (0.2511)*	-2.0387 (0.2831)*	-2.1372 (0.2853)*	-4.619 (0.4403)*	-1.1109 (0.5339)**	-1.3321 (0.5429)*
Years of education	-0.2583 (0.0216)*	-0.2321 (0.0206)*	-	-0.3663 (0.0397)*	-0.3334 (0.0326)*	-
Years of education^2	0.0331 (0.0014)*	0.0259 (0.0014)*	-	0.0402 (0.0027)*	0.0342 (0.0021)*	-
Age	0.3987 (0.0133)*	0.4040 (0.0126)*	0.3930 (0.0125)*	0.3397 (0.0229)*	0.3573 (0.0198)*	0.3545 (0.0197)*
Age^2	-0.0036 (0.0002)*	-0.0038 (0.0002)*	-0.0038 (0.0002)*	-0.0029 (0.0003)*	-0.0033 (0.0002)*	-0.0033 (0.0003)*
Female	-	-1.3403 (0.0485)*	-1.3381 (0.0483)*	-	-1.2895 (0.0721)*	-1.2785 (0.0730)*
Black	-	-2.6658 (0.1221)*	-2.5688 (0.1207)*	-	-2.2185 (0.2518)*	-2.1593 (0.2594)*
Coloured	-	-1.4148 (0.1405)*	-1.3215 (0.1394)*	-	-1.5499 (0.2731)*	-1.4775 (0.2787)*
Indian/Asian	-	-0.7200 (0.1844)*	-0.5909 (0.1830)*	-	-0.3283 -0.3388	-0.2301 (0.3404)
Primary school	-	-	0.1251 (0.0932)	-	-	-0.0632 (0.1541)
Secondary school	-	-	0.2937 (0.0945)*	-	-	0.2125 (0.1578)*
Matric certificate	-	-	0.9731 (0.1057)*	-	-	0.9717 (0.1680)*
Tertiary qualification	-	-	2.7801 (0.1237)*	-	-	3.0664 (0.1895)*
R-squared	0.1959	0.2897	0.2996	0.1744	0.2543	0.2600
n	*31242*	*31190*	*31745*	*29806*	*29761*	*30086*

Note: log of monthly salary (2007 prices) as the dependent variable; all regressions control for province; robust standard errors contained in parentheses; */**/*** significant at the 1%/5%/10% level.

Analysis of the coefficients on these models serves to contradict the notion that there are definite increasing returns to a matric certificate. In the case of the OLS model, changes in the return to a matric (relative to no education) are flat over the seven year period, while for the Tobit approach it decreases slightly.

More interesting, however, is the analysis of the changes in the wage differentials between a matric certificate and the other educational groupings. For one, the data shows that the reward for holding a matric certificate has *fallen* relative to that of a tertiary qualification. The wage differential for holding a tertiary qualification over a matric certificate has increased by 16.1% over the seven-year period for the OLS model (3).[11]

[11]OLS 2000: Tertiary = 278.01%; Matric = 97.31% (assume base wage of R100). Tertiary = R378.01; Matric = R197.31. Difference: 91.6%. OLS 2007: Tertiary = 306.64%; Matric = 97.17%.Tertiary = R406.64; Matric = R197.17. Difference: 106.2%. Overall change = +16.1%.

Table 6: Tobit Regression Results

	LFS 2000			LFS 2007		
	Tobit (1)	Tobit (2)	Tobit (3)	Tobit (1)	Tobit (2)	Tobit (3)
Constant	-	-	-	-	-	-
Years of education	-0.2565 (0.0234)*	-0.2421 (0.0226)*	-	-0.3364 (0.0393)*	-0.3170 (0.0343)*	-
Years of education^2	0.0320 (0.0015)*	0.0258 (0.0015)*	-	0.0370 (0.0027)*	0.0321 (0.0022)*	-
Age	0.5188 (0.0167)*	0.5249 (0.0159)*	0.5159 (0.0159)*	0.4526 (0.0280)*	0.4640 (0.0242)*	0.4611 (0.0240)*
Age^2	-0.0049 (0.0002)*	-0.0052 (0.0002)*	-0.0051 (0.0002)*	-0.0043 (0.0004)*	-0.0045 (0.0003)*	-0.0046 (0.0003)*
Female	-	-1.4904 (0.0565)*	-1.4989 (0.0565)*	-	-1.4072 (0.0824)*	-1.4013 (0.0836)*
Black	-	-2.6318 (0.1454)*	-2.5512 (0.1428)*	-	-1.9689 (0.3199)*	-1.9497 (0.3262)*
Coloured	-	-0.9043 (0.1224)*	-0.8518 (0.1232)*	-	-1.0050 (0.2254)*	-0.9839 (0.2300)*
Indian/Asian	-	-0.4384 (0.1664)*	-0.3436 (0.1692)**	-	0.0725 (0.3355)	0.1149 (0.3411)
Primary school	-	-	-0.0098 (0.1075)	-	-	-0.2190 (0.1569)
Secondary school	-	-	0.1162 (0.1102)	-	-	0.0239 (0.1662)
Matric certificate	-	-	0.9248 (0.1335)*	-	-	0.8908 (0.1903)*
Tertiary qualification	-	-	2.8446 (0.1659)*	-	-	3.0871 (0.2605)*
R-squared	0.0462	0.0708	0.0731	0.0425	0.0643	0.0653
n	*31242*	*31190*	*31745*	*29806*	*29761*	*30086*

Note: log of monthly salary (2007 prices) as the dependent variable; all regressions control for province; robust standard errors contained in parentheses; */**/*** significant at the 1%/5%/10% level.

The Tobit method shows a similar effect, with the differential growing in favour of tertiary qualifications by 16.5%.[12]

Over the same period, returns to matric compared to primary schooling and partial secondary schooling have remained flat or decreased (albeit modestly). Only for the OLS approach when measuring the differential between partial secondary schooling and a matric certificate has there been an increase (5.7%). Whilst the coefficient on the primary school variable is effectively zero in both 2000 and 2007 (i.e. there is no benefit to having some primary school education as compared to no education), the partial secondary schooling coefficient decreases over the same period.

[12]Tobit 2000: Tertiary = 284.46% (assume base wage of R100). Matric = 92.48%.Tertiary = R384.46; Matric = R192.48. Difference: 99.7%. Tobit 2007: Tertiary = 308.71%; Matric = 89.08%. Tertiary = R408.71; Matric = R189.08. Difference: 116.2% Overall change = +16.5%.

6.2 Probability of finding employment - Probit Estimations

Whilst wages are an important labour market outcome, with clear correlation to the type of education level, so too is the effect of the education level on individuals' probability of securing employment. This is especially true of South Africa's labour market. Utilising a probit model, it is possible to test the effect that different educational qualifications have on the probability of finding employment, as specified in models (4) to (6). The evidence from these models is presented in Table 8 below.

Table 7: Probit Regression Results

	LFS 2000			LFS 2007		
	Probit (1)	Probit (2)	Probit (3)	Probit (1)	Probit (2)	Probit (3)
Constant	-	-	-	-	-	-
Years of education	-0.0313 (0.0026)*	-0.0276 (0.0027)*	-	-0.0483 (0.0043)*	-0.0466 (0.0039)*	-
Years of education^2	0.0032 (0.0002)*	0.0023 (0.0002)*	-	0.0048 (0.0003)*	0.0042 (0.0002)*	-
Age	0.0298 (0.017)*	0.0319 (0.0017)*	0.0305 (0.0305)*	0.0405 (0.0025)*	0.0437 (0.0024)*	0.0431 (0.0024)*
Age^2	-0.0002 (0.00002)*	-0.0002 (0.00002)*	-0.0002 (0.00002)*	-0.0003 (0.00003)*	-0.0004 (0.00003)*	-0.0004 (0.00003)*
Female	-	-0.1215 (0.0059)*	-0.1213 (0.0059)*	-	-0.1407 (0.0081)*	-0.1385 (0.0081)*
Black	-	-0.2812 (0.0120)*	-0.2670 (0.0119)*	-	-0.2633 (0.0188)*	-0.2584 (0.0183)*
Coloured	-	-0.2400 (0.0231)*	-0.2253 (0.0230)*	-	-0.2547 (0.0338)*	-0.2457 (0.0332)*
Indian/Asian	-	-0.1555 (0.0322)*	-0.1351 (0.0321)*	-	-0.1266 (0.0431)*	-0.1135 (0.0422)*
Primary school	-	-	-0.0161 (0.0115)	-	-	-0.0477 (0.0190)**
Secondary school	-	-	-0.0306 (0.0117)*	-	-	-0.0316 (0.0189)***
Matric certificate	-	-	0.0027 (0.0127)	-	-	0.0518 (0.0191)*
Tertiary qualification	-	-	0.1691 (0.0118)*	-	-	0.2316 (0.0142)*
Pseudo R-squared	0.0998	0.1463	0.1519	0.1232	0.1772	0.1830
n	*42012*	*41941*	*42718*	*41431*	*41339*	*41902*

Note: employment status as the dependent variable; all regressions control for province; robust standard errors contained in parentheses; */**/*** significant at the 1%/5%/10% level.

The probit model suggests similar, but not the same, patterns as were seen in terms of labour market outcomes for wages. There is convexity in the probability of employment for education level (significant at the 1% level), and again, this is sharper in 2007 than 2000. Racial and gender characteristics also have an effect on employment outcome, as they did on wages. *Ceteris paribus*, females are less likely to find employment than males given education level, race, and province, whilst all previously disadvantaged race groups are less likely to find employment than their white counterparts. In contrast to the evidence of shrinking wage differentials between genders and

races presented earlier, there has been little change in the employment probability differences between the groups over the seven years.

Focusing on the effect of education level on employment outcomes, several interesting features of the data can be seen. Firstly, primary or partial secondary schooling has a negative effect on the probability of finding employment relative to individuals with no education (these coefficients are significant, although not at the 1% level). This effect also appears to be strengthening over time, as the coefficient on primary schooling has gone from being insignificant to significant and negative, over the seven year period (the coefficient on secondary schooling has become marginally more negative, and remained significant at the 10% level). The intuition here suggests that an individual is more likely to find a job with no education than with partial basic education.

Secondly, a matriculation certificate has gone from being an insignificant predictor of employment in 2000 to a significant (at the 1% level) and positive one in 2007 (5.2%). This suggests that the qualification acts in a nuanced way. Whilst the returns to a matric certificate appear to be declining relative to other educational levels over time, holders of the qualification having an increasing likelihood of finding employment. This suggests that a matriculation certificate is increasingly important in aiding the hiring decision of employers. Those with primary schooling or incomplete secondary schooling have less likelihood of gaining employment, whilst a matric certificate is seen in 2007 to be an important and positive factor in determining employment.

Lastly, tertiary qualifications have a persistently positive and significant effect on finding employment over the both time periods. Furthermore, the magnitude of this variable is large relative to other factors (both educational and non-educational) and growing over time.

6.3 The Cragg model

At this juncture, an important opportunity is presented. Whilst the effect a matric certificate has had on earnings in the observed seven-year period is mixed, it is apparent that the qualification has become significant in its effect on the probability of finding employment. Using the model proposed by Cragg (1971), it can be tested whether the factors that determine the probability of finding employment differ significantly to those that determine

wages earned given employment.[13] This is done because the Tobit approach holds that the same set of variables and, importantly, the same coefficients determine both the probability of truncation (unemployment) and the expected value of the realisable dependent variable (earnings) (Breen, 1998).

The Cragg model involves running the Tobit and probit models, as well as truncated regressions, and then running a likelihood-ratio (LR) test to confirm whether the factors differ in the case of the probit and truncated regressions. Results of the LR test show that there is a highly significant difference in the factors that determine wages and the factors that determine employment status in both the 2000 and 2007 data.[14]

Table 8: LR Test statistics for the Cragg model

	Test results	
	LR Chi statistic	p-value
LFS 2000	3.73×10^7	0.00
LFS 2007	3.89×10^7	0.00

This finding provides a nuanced view of the role of a matric certificate in explaining earnings versus employment status over time. The role of a matric certificate (and other factors) may have a different impact on the search for employment than on the wages earned given employment. Indeed, it is indicative of the need to separate out the regressions into a wage function for the employed and an employment probability model for the labour force. Whilst the coefficients and robust standard errors given by the probit model remain valid, separate truncated regressions are needed to determine the actual effects of education factors on earnings (rather than simply an OLS Tobit model). Given space constraints, a full re-interpretation of the results cannot be done, however, the results are included in Appendix A2.

6.4 Signalling framework

Of interest to this paper is the use of the truncated regressions to investigate possible changes in the signalling quality of educational qualifications. Importantly, the fact that truncated regressions are now used allows for the

[13] Guerts, Jansen and Van Tilburg (1997:27) sum the idea up succinctly when they say that the "Cragg model can be regarded as an extended version of the Tobit model where the probability of a non-limit outcome is determined separately from the level of the non-limit outcome".

[14] Regressions are run according to model (3) for all three approaches.

control of the industry in which the individual is employed. Previously this would have proved useful although was not possible, because of the spurious correlation it would have caused between the unemployed observations and the dummy variable for 'no industry given unemployed'.

To test for the effect of changing signal qualities (through employer perceptions) on wages, a basic signalling framework is established. To evaluate changes in signalling quality, the data sets are separated into categories corresponding to when the matric qualification was received. This data disaggregation allows one to analyse the change in returns of a qualification for the time period in which it was received.

The data sets are thus broken up into three periods - those who achieved their qualification before 1994, those who received their qualification after 1994 but before 2000 (initial period of post-apartheid education), and those who achieved their qualification after 2000 (the more recent recipients of post-apartheid education). The average age of a matriculant in 1994 is assumed to be 19 years. However, in order to capture the entire group of 'young' labour force participants, the age 15 years and older is used. In 2000, six years had elapsed since post-apartheid education was introduced. Therefore the age group for our first post-apartheid cohort is 15 to 25 years of age. The second cohort is just taken as the gap between the 2000 and 2007 surveys, with an associated age structure of 26 to 32 years. The base age grouping is individuals aged 33 years and older (to a maximum of 65 years).

To capture the effect of when the qualification was received, interaction terms are created between the age group the individual is in and whether that person has the qualification or not (see Appendix A3). The focus of this investigation is on the changing rewards of a matric or tertiary qualification. Therefore, only interaction terms are run on these categories. Truncated regressions, with these interaction terms, are run over both time periods, with the summarised results of the interaction terms shown in Table 10.

Regressions using this simple framework provide for a revealing insight into changes into the reward structure of the South African labour market. By analysing the relative changes in the rewards to each age cohort over time, one can see two contrasting points. Firstly, there are strictly decreasing returns to when a matric certificate was received. This indicates that the farther back one received a matric certificate, the less the returns to that certificate have decreased. Whilst returns for a matric certificate obtained before 1994 fell by 11.1%, this decrease was more than double for the most recent matriculants, at -25.6%.

Table 9: Interaction Terms for Truncated Regressions

	2000 Coefficient	2007 Coefficient	Relative Change
Pre-1994 Matric	0.7627	0.6780	-11.1%
1994-2000 Matric	0.4069	0.3537	-13.1%
Post-2000 Matric	0.2765	0.2056	-25.6%
Pre-1994 Tertiary	1.1650	1.2972	11.3%
1994-2000 Tertiary	0.9485	1.0796	13.8%
Post-2000 Tertiary	0.6788	0.9262	36.4%

Note: The results here control for education level, gender, race, province, and industry.

Secondly, and conversely, the returns to tertiary qualifications are increasing, and this increase is seen most in the lower age groups. The change in returns for those who received a tertiary qualification after 2000 (and the beginning of the restructuring of higher education institutions) are almost treble the change for pre-1994 tertiary qualification holders and two-and-a-half times that of the group of tertiary recipients after 1994 but before 2000.[15]

The fact that the fall in returns for the matriculants between 1994 and 2000 is slightly more, but close to, the fall in returns for pre-1994 matriculants indicates that it is the more recent matriculants that are most negatively affected by changes in earnings. The signalling hypothesis proposed here would be consistent with this finding. It is possibly as a result of the increased phasing in of the OBE syllabus and therefore increasing uncertainty for employers over the matric certificate as a guide to employee skills and resultant productivity.

While it appears employers' view of matric as one of declining signalling quality, the opposite is true for tertiary qualifications. Despite similar wide-scale reforms of the higher education sector in the early 2000s, these reforms appear to have either had a benign or positive effect on employer's perceptions. Moreover, it is possible that the employers prefer potential employees with tertiary qualifications over those with only a matric certificate, chang-

[15]Importantly, these movements are not limited to only the change in wages between matric and tertiary qualifications relative to no education level. The results are mimicked when analysing changes relative to primary and secondary schooling.

ing the wage differential between the two in response. The fact that the largest changes in real earnings are in the youngest age categories also indicate that there is credence to the work done by Altman and Marock (2008) that show that matric is now seen as a minimum requirement by many employers. In fact, the work here shows that a matric certificate may be enough to secure employment, but it is not enough to sustain earnings that were previously experienced.

7 CONCLUSION

This paper provides compelling evidence that returns to a matric certificate have declined between 2000 and 2007. Whilst initial OLS and Tobit regressions suggest that returns are rising for individuals in possession of a matriculation certificate, further investigation proves this not to be the case. After separating out the estimations in line with the findings of the Cragg model, this is evidenced by the changes in the coefficients (and thus returns) of the key variables.

Returns to a matric certificate may be falling over time, but the qualification is playing an enhanced role in garnering employment. This suggests a dual nature of the matric certificate. It appears that, in line with the findings of Altman and Marock (2008), a matric certificate is increasingly viewed as a requirement for attaining employment. Individuals holding a matric certificate are thus more likely to find gainful employment than those who hold no education, primary schooling, or incomplete secondary schooling. This is not present in the 2000 data, but is in 2007, evidencing the increasing importance employers place on applicants possessing a matric certificate.

Perhaps most important of all is the finding that the change in returns to educational qualifications have depended largely on *when* the qualification was received. Matriculants who received their qualification after the fall of apartheid have seen larger declines in educational returns than those who received their qualifications before. Strikingly, these declines are almost three times the magnitude for the post-2000 cohort of matriculants. This coincides with the wide-scale reform of the education system in South Africa. Conversely, individuals with tertiary education holders have seen increases in returns to their qualifications. This disaggregation of the data into when the qualification was received provides evidence to suggest that the falling returns to basic education (primary, secondary and matric) may be a result of a decline in the quality of the signals such education sends employers. Whilst post-apartheid basic education and the matric certificate have had a negative effect on signalling quality *vis-a-vis* employer perceptions, tertiary

qualifications for the same period suggest higher education reform has either had a positive effect on the signal such education sends, or there are other factors at play.

Despite the enlightening findings here, discussions are hampered by the generalisability of the results. The problem of missing data due to non-reporting of incomes prevents more widespread implications of the findings being considered. The results do, however, provide evidence of the changing nature of signalling phenomena within the education system and labour market of South Africa.

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APPENDICES

Appendix A1 - Employment Status Models

Probit models for employment status are given by the following:

$$employment\ status = \ln a + \beta_1 educ + \beta_2 educ^2 + \beta_3 age + \beta_4 age^2 \quad \text{(A-1)}$$

$$\begin{aligned} employment\ status = \ln a \quad &+ \quad \beta_1 educ + \beta_2 educ^2 + \beta_3 age + \beta_4 age^2 \\ &+ \quad \sum_{j=1}^{2} \Omega gender + \sum_{j=1}^{4} \Delta race \\ &+ \quad \sum_{j=1}^{9} \sigma province \end{aligned} \quad \text{(A-2)}$$

$$\begin{aligned} employment\ status \quad &= \quad \ln a + \beta_1 age + \beta_2 age^2 \\ &+ \quad \sum_{j=1}^{5} \delta education\ qualification \\ &+ \quad control\ variables \end{aligned} \quad \text{(A-3)}$$

Appendix A2 - Full Truncated Regression Results

	LFS 2000			LFS 2007		
	Truncated regression (1)	Truncated regression (2)	Truncated regression (3)	Truncated regression (1)	Truncated regression (2)	Truncated regression (3)
Constant	4.4519 (0.1136)*	5.3267 (0.1078)*	5.4410 (0.1130)*	5.7695 (0.1758)*	6.5537 (0.1485)*	6.5980 (0.1588)*
Years of education	-0.0096 (0.0077)	-0.0088 (0.0070)	-	-0.0799 (0.0155)*	-0.0704 (0.01354)*	-
Years of education^2	0.0115 (0.0005)*	0.0096 (0.0005)*	-	0.0148 (0.0011)*	0.0130 (0.0008)*	-
Age	0.0941 (0.0058)*	0.1089 (0.0052)*	0.1076 (0.0053)*	0.0420 (0.0083)*	0.0561 (0.0069)*	0.0575 (0.0070)*
Age^2	-0.0009 (0.00007)*	-0.0011 (0.00007)*	-0.0011 (0.00007)*	-0.0003 (0.0001)*	-0.0005 (0.00009)*	-0.0005 (0.00009)*
Female	-	-0.4496 (0.0158)*	-0.4497 (0.0162)*	-	-0.4090 (0.0259)*	-0.4087 (0.0254)*
Black	-	-0.7718 (0.0320)*	-0.8280 (0.0335)*	-	-0.7309 (0.0737)*	-0.7761 (0.0755)*
Coloured	-	-0.4931 (0.0420)*	-0.5364 (0.0438)*	-	-0.4350 (0.0789)*	-0.4859 (0.0809)*
Indian/Asian	-	-0.3072 (0.0438)*	-0.3146 (0.0454)*	-	-0.2201 -0.2201	-0.2630 (0.0882)*
Primary school	-	-	0.3141 (0.0334)	-	-	0.1880 (0.0622)*
Secondary school	-	-	0.7275 (0.0342)*	-	-	0.5302 (0.0638)*
Matric certificate	-	-	1.2293 (0.0381)*	-	-	1.0080 (0.0681)*
tertiary qualification	-	-	1.8039 (0.0416)*	-	-	1.7460 (0.0726)*
R-squared*	0.4275	0.5395	0.5241	0.3866	0.4945	0.4895
n	*16415*	*16383*	*16789*	*13634*	*13610*	*13813*

Note: log of monthly salary (2007 prices) as the dependent variable - no zero income values; all regressions control for province; robust standard errors contained in parentheses; */**/*** significant at the 1%/5%/10% level; R-squared values are for an equivalent OLS regression.

Appendix A3 - Interaction Terms from Truncated Regressions (positive earnings only)

	LFS 2000		LFS 2007	
	(1)	(2)	(1)	(2)
Age group (under 25)	-0.6653 (0.0311)*	-0.4862 (0.0274)*	-0.4135 (0.0350)*	-0.3710 (0.0317)*
Age group (25 to 32 years)	-0.3101 (0.0252)*	-0.2165 (0.0226)*	-0.2304 (0.0380)*	-0.2176 (0.0344)*
Matric certificate	1.2323 (0.0413)*	0.7627 (0.0353)*	0.9940 (0.2019)*	0.6780 (0.0755)*
Matric certificate * Age group (under 25)	0.0547 (0.0557)	-0.0410 (0.0506)	-0.0799 (0.0603)	-0.1014 (0.0556)***
Matric certificate * Age group (25 to 32 years)	-0.1002 (0.0450)*	-0.1393 (0.0420)*	-0.1104 (0.0665)***	-0.1067 (0.0642)***
Tertiary qualification	1.7368 (0.0452)*	1.1650 (0.0401)*	1.6763 (0.0802)*	1.2972 (0.0897)*
Tertiary qualification * Age group (under 25)	-0.0239 (0.0769)	-0.1075 (0.0716)	0.0248 (0.1807)	-0.0182 (0.1757)
Tertiary qualification * Age group (26 to 32 years)	0.1815 (0.0558)*	0.0626 (0.0508)	0.0494 (0.1074)	0.0544 (0.1060)
R-squared *n*	0.5166 *16903*	0.6273 *16851*	0.4844 *13935*	0.5559 *13928*

Note: log of monthly salary (2007 prices) as the dependent variable; regressions control for race, gender, province, and industry; robust standard errors contained in parentheses; */**/*** significant at the 1%/5%/10% level.