Persistent Reservations in Mining?

by

Tom Magara Njeru

NJRTOM001

Abstract

This paper analyses the persistence of colour bar reservations into the present day mining sector. Focusing on the occupations Banksman/Onsetter, Blaster, Engineer, Labourer and Winding Engine Driver, an ordered probit regression is run producing little evidence to support the persistence. A White skill bias is noted and further investigated using Oaxaca decomposition. Observable skill sets such as education, experience, demographics and firm level characteristics are unable to adequately explain the occupational gap between the races. This might suggests some skill based discrimination is still rife, however with various unobservable characteristics the model cannot control for; a causal relationship cannot be confidently concluded.

Acknowledgements

The author would like to express his gratitude to numerous individuals who supported and helped with completing this paper. First, the author would like to thank his parents (Anne and Alphan Njeru) who have continued to provide financial and emotional support, as well as encouragement and guidance throughout his life. Next, he would like to thank his dedicated supervisor Patrizio Piraino, without whom he would have lacked all sense of direction. Furthermore to his siblings (Joe, Mark, Christine and Phyllis) who through humour, consideration and encouragement got him through the ordeal. Finally to his friends Kui, (whose persistence and drive ensured he only slept, worked and never lost hope), Samson (whose incredible attention to detail ensured as few grammatical errors were made), Janet (who covered countless shifts for him to guarantee enough time to focus on his work), Noella (who not only discovered, but managed to gain him access to pre independence legislature) and to all those the author cannot mention.

1 Introduction

South Africa (SA) has had a varied and repressive history to date with democracy being a fairly new notion. Both the Colonial and Apartheid eras exhibited vast racial segregation that intended to keep the races[1] stratified along economic and spatial lines. To achieve this end, legislature was used extensively in conjunction with other assorted means; the consequences of which are far reaching and not fully established yet.

This paper looks purposely at the effect job reservation laws in the mining sector have had on the present day labour market. These laws dictated the exact jobs each race was allowed to be employed in, with White's protecting the most skilled and highly remunerated jobs for themselves. It is the aim of this paper to determine whether these job reservations have persisted over time, by analysing the probabilities associated with each race holding the same specific occupations cited in pre-independence legislation in the present day.

Focussing on the occupations Banksman/Onsetter, Blaster, Engineer, Winding Engine Driver and Labourer that are frequently cited in reservation laws, Labour Force Survey data is made use of from 2000 to 2013 to determine the likelihood of persistence. Despite data concerns, little evidence is found to suggest the restrictions have persisted at lower education levels to the present day mining sector.

To further determine if some form of skill based discrimination has persisted, the paper converts occupation into a continuous variable and uses an Oaxaca decomposition (1973) to analyse how much of the occupational gap between the races can be explained by education, experience and other firm specific characteristics. It is found that a large portion of the gap cannot be explained with this model. It should be noted that the design of the analysis and dataset used suggest that considerable caution in interpreting the results as causal should be taken. However, the paper provides a plausible model through which, with the aid of more detailed data, could be used to analyse occupational gaps.

The paper shall take up the following format. Section 2 describes the reservation and corrective laws associated with labour in South Africa. Section 3 scrutinises the methods through which these occupational transmission may have occurred. Section 4 looks closer at the data. Section 5 considers the ordered probit estimation model and its findings. Section 6 addresses converting occupation into a continuous variable and making use of Oaxaca decomposition. Section 7 concludes, describing further research avenues and recommendations.

[1] These are: African/Native (Which the author refers to as Blacks), Asians, Coloureds and Whites.

2 Reservation Laws

A detailed history of the colour bars and their effectiveness is analysed in this section.

History of Job Reservation Laws in the Mining Sector in South Africa

Slavery officially ended in the Cape of Good Hope (the then colony of the British Empire) in 1834 after the British House of Commons passed the Slavery Abolition act of 1833. The slaves were legally free; however they were required to remain in the service of their current masters as apprentices for 4 more years.

Following this, the Master and Servant Acts passed between 1841 (in the Cape) and 1910 (when the Union was formed; joining the Cape, Natal, Transvaal and Orange River Colonies together) maintained the slavery like relationships between employer and employee (Simons & Simons, 1983; South African History Online [SAHO], n.d.). The laws stipulated any breach of employment contract became a criminal offence, punishable on the employee. Despite the term "servant" applying to all employees regardless of race, Whites were rarely prosecuted for said breaches (Simons & Simons, 1983). These laws ensured predominantly Black and unskilled[2] labourers remained tethered to White employers (The Truth And Reconciliation Committee [TRC], 1998).

The first direct colour bars were enacted in the mining industry in 1892 and 1893. Their purpose at the time was strictly safety related with the then State Mining Engineer, Joseph Adolf Klimke, focussed on reducing the significantly high number of deaths occurring in mines (Katz, 1999; Wilson, 2011: 7). Two operations were believed to have the highest likelihood of injury occurring; these were explosions and the hauling of people in cages and skips. The First and Second Volksraad (1892 and 1893 respectively) as a result passed laws forbidding "unskilled creatures[3]" from handling dynamite. Despite the laws, deaths per accidents remained particularly high in 1894 at 4.4 per 1000, compared to 1.6 per 1000 in England (South African Mining Journal, cited in Katz, 1999).

The colour blasting bar was abandoned in 1896 as it made no provision to ensure White blasters were formally trained. Instead, the law now called for any "person" to acquire a blasting certificate before being allowed to handle dynamite (Law 12 of 1896 Sections 89 to 92, cited in Simons & Simons, 1983). It was, however, by and large assumed that certificate holders would only be White, with the possibility of competent and experienced Blacks and Coloureds merely acting as assistants.

Furthermore, the law stipulated that only Whites could be winding engine drivers[4], banksmen and onsetters[5], and they too were required to gain competency certificates (Katz, 1999). The

[2] Unskilled and semi-skilled jobs both generally have no academic application requirements; however the later offers on-the-job training while the former does not (Mariotti, 2011).
[3] Asians, Blacks and Coloureds.
[4] Person in charge of driving cages and skips that haul people.

engine driver restrictions had been motivated by mining unions in an attempt to ensure job security for the Whites (Simons & Simons, 1983; Roback, 1988). Mine owners would have preferred hiring experienced Black and Coloured workers instead as their wages were substantially lower.

Through pressure from the Chamber of Mines and the Association of Mine Managers that was brought about by their belief that persons of colour could be just as competent as Whites in those particular jobs, the mining regulations were further amended. Banksmen and onsetters could be tackled by "qualified" persons, while machine-driver's certificates could only be issued to "coloured" people (Law 11, 1897 Section 39 (m) and Law 12, 1898 Section 104 cited in Alexander & Simons, 1959 and Simons, 1961).

These laws were repealed in 1903, restating that only Whites could be employed as managers, engine drivers, banksmen and ontsetters (Government notice 826 of 1903 cited in Simons & Simons, 1983). This list grew in 1906 to include boiler attendant, lift operator, shift boss, surface foreman, mine overseer and mechanical engineer (Government notice 173, 196 and 1232 of 1906, cited in Simons & Simons, 1983).

What followed then was a series of laws whose intention was the restriction of skilled and semi-skilled jobs to Whites (regardless of their education level) as they offered higher economic remuneration, and had competition been allowed, they would have struggled to contend with informally-trained Black and Coloured workers (Doxey, 1961: 98). Unskilled manual and often unfavourable jobs were therefore left to Non-Whites.

This ushered in the era of the Mine and Works acts, with the first being passed in 1911. Its motivation, however, was yet again claimed to be the protection of lives and limbs (Alexander & Simons, 1959; Simons & Simons, 1983). The law did not out-rightly assert any colour based discrimination (Mines and Works Act, No 12 of 1911, 1911), but rather gave the Governor-General the power to issue regulations determining who could attain competency certificates in particular jobs. In the Transvaal and the Orange Free State provinces, these certificates were not issued to persons of "colour", and in addition those issued to "persons of colour" outside the provinces (in the Cape or Natal) were void when brought into these two provinces (Doxey, 1961: 158).

The 1926[6] Amendment[7] re-established the colour bars by stating only Whites and South African born coloureds[8] could be issued competency certificates (Mines and Works Amendment Act, No 25 of 1926, 1926). Among other jobs, these included mine manager, overseer, surveyor, engineer, assayer[9], blaster, winding engine driver, boiler attendant and lampman. While still guised under safety, these laws were pursued to prevent job competition

[5] Banksmen and onsetters signal to operators of cages and skips.
[6] They were re-invigorated by the coming to power of the coalition of the Labour Party and the National Party Alliance led by Hertzog in 1924 (Gardner, 1990: 19).
[7] As a result it was commonly known as the Colour Bar Act (Alexander & Simons, 1959: 3).
[8] Or had they resided in the Cape would be known as Cape Coloureds or Malays.
[9] An analyst who performs chemical tests on metals.

(Doxey, 1961: 160). The 1956[10] Amendment acted only to re-emphasise the reservations (Mines and Works Amendment Act, No 27 of 1956, 1956).

When the Industrial Conciliation Act, No 28 of 1956 was passed which dropped Blacks from the very definition of employees and gave the Minister of labour the authority to reserve any job to a particular race, the mining sector was left to govern itself based on the Mines and Works Acts. The later amendment in 1959 dropped this exclusion; however, the industry maintained the pre-existing job reservations (Doxey, 1961: 143). The Industrial Conciliation Act further refused Black membership into trade unions (TRC, 1998; SAHO, n.d.).

Other regulations passed were less direct, and instead prohibited the means by which particular races could attain relevant qualifications for said jobs. For instance, the Bantu Education Act No 47 (1953) and the Extension of University Education Acts No 45, 32 & 67 (of 1959, 1960 and 1963 respectively), instituted separate educational systems that offered Blacks, and to a slightly lesser extent Coloureds and Asians, substandard education tailored to keep them unskilled.

Compounding on this, the Apprenticeship Act (1922) and its amendment (1944) required potential candidates for various apprenticeship programs to have attained a minimum level of education[11] unachievable at Non-Whites schools. This kept skilled jobs out of reach of the Non-Whites. It should be noted that the Act made no provisions for the apprenticeship training to maintain any standards, and, in fact, made no obligations to have apprentices pass any qualifying examinations (Doxey, 1961: 132; Wilson, 2011:12). Informally trained workers could possibly be just as knowledgeable about the job, with only race determining employment.

Efficacy of Laws

Job restriction laws passed over the pre-independence era generally formalized customs that were already inherent in the labour markets (Katz, 1999). Consequently, dropping of any colour bars would have had little effect in changing hiring policies in some specific occupations.

Mine owners and managers were, however, in constant conflict with job reservation laws as their main focus was profit maximisation which required hiring autonomy. Having to pay higher wages to Whites in jobs experienced (at times not necessarily) Blacks could do for a fraction of the cost made little economic sense[12]. An example of this came right after the first colour bar was instituted in September of 1892 forbidding Blacks from handling dynamite. Industry players lodged considerable protests stating it was logistically impossible to have

[10] As a result of the National Party's coming to power in 1948 (Gardner, 1990: 19).
[11] Minimum entry level was Standard VI (Apprenticeship Act of 1922, 1922; Wilson, 2011: 12)
[12] Blacks were not legally regarded as employees (Industrial Conciliations Act No. 11 of 1924, 1924) and as such were not entitled to minimum pay (Wage Act No. 27 of 1925, 1925).

Whites at each explosion (Katz, 1999). This led to the law being redrafted in October the same year to allow Blacks to fire explosives, under the supervision of White Gangers[13].

Economic realities and general skill shortages, furthermore, created incentives to informally relax the restrictions, despite their strict enforcement. This was experienced, for example, in the 1950's where Blacks were hired in semi-skilled jobs, which they legally were not allowed to hold, as the semi-skilled labour supply decreased due to rising White skill acquisition (Gardner, 1990: 19; Mariotti, 2011). This was brought about not by a change in racial predisposition, but rather by the increased returns that Whites could gain from pursuing higher skilled work or migrating to the expanding manufacturing sector, and thereby leaving semi-skilled jobs to Non-Whites (who were commonly still paid unskilled wage rates). The Apprenticeship Act also experienced circumventions either through occupational passing, for instance to Coloureds, or through blatant evasion (Doxey, 1961: 133).

Lastly, it cannot be entirely ruled out that the word "coloured" might not have been misconstrued to mean "person of colour" instead of the "Coloured race" or vice versa in the interpretations of the laws.

Laws that Sought to Redress Discrimination

All job reservation laws were repealed in 1979 (Industrial Conciliation Amendment Act, No 94 of 1979). Subsequently, the newly elected African National Congress (ANC) government sought to correct the unjust work place discriminations and general inequality through further legislature in the form of Affirmative Action [AA] (Employment Equity Act, No. 55 of 1998, 1998: chap 3) and Broad-Based Black Economic Empowerment [BBBEE] Acts (BBBEE Act, No. 53 of 2003, 2004: s1).

The efficiency of AA laws have been extensively researched and found to be most effective in increasing employment of minorities in years immediately after their enactment (Kalev, Dobbin & Kelly, 2006; Kurtulus, 2011). Miller and Segal (2011), and Long (2007) furthermore found that contingent on the laws being adequately enforced; these effects have been long lasting. They however have opposing opinions on the continued diversification effect once the laws have been terminated. Nevertheless, there has been no conclusive evidence as to the validity of the hypothesised negative effects of reverse discrimination or reduced productivity in the economy (Leonard, 1990).

The Mine Health and Safety Act (1996: chap4 s41 and s45) established a Mining Qualification Authority (MQA) which in conjunction with the Skills Development Act (1998: chap1 s2) set about to use training and education to provide the previously disadvantage a chance of competing in the work force by redressing the educational disparity. They aim to achieve this goal by designing curricula, offering opportunities and funding, and monitoring their outcomes (MQA, 2003 – 2012). These initiatives take the form of basic, further and

[13] A supervisor of a group of African workers.

higher education and training, as well as apprenticeships, artisan training, learnerships and work-place training.

Moreover, through the combined effort of the Competition Act (No. 35 of 1999) (amended in 2000) and the Preferential Procurement Policy Framework Act (No. 5 of 2000), businesses and employers were further forced to ensure active steps are taken to provide equitable opportunities for the previously disadvantaged.

3 Intergenerational Transfer

This section considers possible avenues through which intergenerational transfers may have assisted in passing the legislative colour bars through generations despite the reservation laws being repealed.

Oppressive legislature has been found to have long lasting effects on the intended subjugates long after the laws have been repealed. Gaskin, Headen and White-Mean (2005) found that slavery, racial segregation and discrimination of African Americans had caused long term decreases in their health and wealth through inadequate human capital transmissions across generations. Similarly Dell (2010), using Peru's "Mita" laws that were enacted to force indigenous communities to work in Spanish mines, showed after 200 years since the laws had ended, the inflicted communities exhibited lower consumption levels, increased stunted growth and under development of the communities at large.

This echoes Acemoglu, Johnson and Robinson's (2002) idea of extractive institutions established by colonists where they concentrated power within a minority elite that offered expropriation of private property for the greater good. The result of which was the discouragement of investment and economic development, turning once prosperous communities into poor nations for example the Mughals in India and the Aztecs in Americas (Acemoglu, et al., 2002).

Intergeneration transfers can be transmitted through socio-economic outcomes of a family. That is, parent's socio-economic status is normally transmitted to a child. This occurs through the parent's level of developmental nourishment in the form of education, healthcare, exposure, among others, that said parent can provide his/her child (Knudsen, Heckman, Cameron & Shonkoff, 2006). Taking this into account, equalising of social equity in the population would mean that poorer parents could provide more support to help their children have better standards of living.

Building on this, Krueger (2012) and Corak (2013) expressed that the higher the income inequality experienced in a country, the lower the rate of intergenerational mobility across socio-economic classes. The transmission of innate abilities and nurturing into particular

careers would steer children into similar occupations as their parents. With SA's high income inequality (Leibbrandt, Finnd & Woolard, 2012) high immobility would be expected, thereby maintain the reservations.

Occupational transmissions would also be driven by social networks. Social networks have been used in varied settings to decrease costs of searching for jobs and to take advantage of more experienced workers connections (Munshi, 2003). This makes them a particularly effective tool for the disadvantaged members of society who experience the most difficulty of entering the labour force. The use of these networks then again have been found to be limiting with regards to movement away from low-skilled jobs as these networks only have foundations within low-skilled industries. Attempting to move to more skilled industries would mean no longer having access to the networks (Munshi, 2003).

Employers also use these networks by requesting referrals from their already existing employee base. As these employees would know candidates personally, this would reduce the information asymmetry between employer and potential employee (Montgomery, 1991; Munshi, 2003). Employees refer individuals within their social networks and more so relatives when their performance is not related to the referees rewards (Beaman & Magruder, 2012). Also high ability employees are better at screening and referring similarly high skilled individuals increasing likelihood of employment.

Compounding this further, Hellerstein and Morrill (2011) established that as women in United States of America increasingly joined the labour market, the likelihood of them following the same profession as their fathers increased. Using father-in-laws occupations as counterfactuals, the increased probability was found to be attributed to human capital transmission effects from father to daughter. In comparison, son's probabilities of following father's occupation remain unchanged.

Lastly, a decomposition of the large occupational gaps between Whites and Blacks in 1970 and 1980 can be accredited to education differentials brought about by the segregation of educational systems (Mariotti, 2011). As intended, Blacks have remained relatively unskilled and thus have been unable to compete for high-skilled jobs. Jobs have, as a result, remained racially skewed. The highest and lowest skilled jobs have the largest intergenerational immobility (Eberharter, 2006). In addition, educational attainment can increase probability of climbing the occupational ladder.

4 Data

This section gives a brief overview of the mining industry and data sets used in the paper.

Mining Sector

The South African mining sector ballooned from the discovery of the first diamond in 1867 [SAHO, 1946] to the billion Rand industry it is today. It not only produces precious minerals, metals, and coal, but leads the world in various deposits, such as platinum and palladium. Mining as a function of nominal contributions to Gross Domestic Product (GDP) is concentrated in North West, Limpopo, Mpumalanga and Gauteng Provinces.

Since early 2000's, direct employment in the mining sector has fluctuated between 406,000 to a high of 524,632 in 2012. Remunerations have seen an annual real rise peaking at R 93.6 billion in 2012 while paying R 11.6 billion in dividends and R 21.4 billion in tax. Mining contributed 8.3% of the GDP in 2012 (Chambers of Mines, 2013).

Being such a vital industry in the South African economy as well as the first industry to introduce colour bars, the mining sector provides an interesting case study worth analysing further.

Labour Force Survey Datasets

Labour Force Survey (LFS) and Quarterly Labour Force Survey (QLFS) datasets were used in the analysis of this paper. LFS data was pooled from 2000 to 2007 and merged with QLFS data pooled from the first quarter of 2008 to the fourth quarter of 2013. The data is collected by Statistics South Africa (StatsSA).

LFS and QLFS are general purpose household surveys carried out across South Africa having about 30,000 representative dwellings in each survey, that are based on information collected during 1996 and 2001 censuses. Rotational panel methodology is employed in which dwellings are sampled again in subsequent surveys before being dropped out in about the 4th round in order to capture movements in and out of the labour market over time (StatsSA, 2013). LFS is carried out biannually while QLFS is quarterly. The pooled dataset has a total of 917,507 observations of working individuals.

There were concerns about duplication of individuals due to sample rotation and changing of methodologies employed in the surveys along the years[14]. For example, as the Unique Household identifiers were revised thereby not ensuring consistent identification, the same individual could potentially be included in the survey more than once. This would introduce multicollinearity that would reduce the precision of the estimates and their significance. Checking for duplicates based on race, gender, occupation, year commenced working and

[14] 2005 saw a revision of the methodology, questionnaire and frequency of data collection, culminating in the conversion of LFS to QLFS in 2008.

highest education achievement attempted to control for this. Whereas race and gender could not be altered, it would be unlikely to expect the rest not to change over time, thus allowing for duplication. Alternatively, false matching where two different individuals were merged as one was an added concern that if true would result in erroneous output (Ranchod & Dinkelman, 2008).

Unfortunately, with no alternative data sources and significantly few White and Coloured observations already, as well as the author's lack of econometric know how to attempt to resolve the issues, the merged data was used as is. Data directly sourced from the Chamber of Mines would have been more appropriate with less sample error, but was unattainable.

Limiting the dataset to only those employed in the mining sector, the total number of observations fell to 8,956: where 79.9% of these are Black, 15.3% White and 4.9% Coloured[15][16]. Males make up 89.6% of the mining employees. Table 1 below shows some summary statistics of the data.

Table 1: Summary Statistics

Variable	**Count**	**Percentage %**
Race		
Black	7,151	79.85
Coloured	439	4.90
White	1,366	15.25
Demographics		
Male	8,022	89.57
Female	934	10.43
Married	6,263	69.93
Sector Characteristics		
Occupations	210	
Industries	11	

Notes: Sample is restricted to the Mining Sector.
N = 8,956
Source: Author's calculations using merged LFS and QLFS data sets.

[15] The full dataset had 26 Asians/Indians making up 0.30% of the sample. Due to lack of variability, they were dropped out of the sample.
[16] These figures seem reasonable as 2001 Census data reveal Blacks making up 83%, Whites 14%, Coloureds 3% and Asians 0.4% of the mining sector.

Coding of occupations[17] in the datasets was done using the four digit South African Standard Classification of Occupations (SASCO). This criterion allows for the specification of employees main activity that is required for the analysis below.

5 Ordered Probit Estimations

In this section the paper attempts to determine the probability that a particular race still holds the same occupations described in Section 2 above. To achieve this, an ordered probit regression as described by Greene (2011: 221) and used in Darden (2005) and Kasteridis, Munkin and Yen (2010) is employed.

Selection of Dependent Variable

Based on the laws listed in Section 2 above and the occupation categories available in SASCO, the analysis focuses on the following occupations: Banksmen[18]/ Onsetters, Blasters, Winding Engine Drivers, Engineers[19] and Labourers.

Blasting was the first occupation to be restricted on racial lines in 1892 where only Whites were allowed to handle explosives under the guise of safety. Repealed in 1986, the practice remained relatively unchanged until it was re-instated in 1926, adding Coloureds to the select few allowed. This continued until the end of the colour bars.

Winding Engine drivers features significantly in job reservation legislation. It was first mentioned in 1893 (Section 12) where it was, at the time, regard as a skilled job limited only to Whites. It was further re-emphasized in Laws 11 and 12 of 1896. Legislation however changed in 1897 (Law 11), reserving the profession to Coloureds alone. This law was repealed in 1903, thereby re-instating the previous bar restricting the occupation solely to whites. In 1911, the Mines and Works act limited the post to both Whites and Coloureds, a stipulation that stood until the end of colour bars in 1979.

Job reservation laws commonly regulated Onsetters and Banksmen. The 1893 legislation started by prohibiting Blacks, Coloureds and Indians from working in that capacity. It was again re-emphasized in 1896 and 1903 regulations. It was not mentioned out rightly again, however can be assumed to have been treated similarly to other skilled jobs at the time.

The 1896 legislation as well, restricted Engineering (specifically mechanical) to only Whites. The restriction held until 1911, when Coloureds where legally added into the authorized elite. It was only repealed in 1979 with all other colour bars.

Labourers were chosen to signify the general manual labour available in mines. These jobs were commonly left to Blacks and Asians.

[17] All employed persons aged 15 and above.
[18] The term Banksmen includes Bankswomen
[19] This includes all forms of engineering such as Civil, Electrical, Mechanical, Chemical and Mining.

Table 2 below shows a breakdown of each occupation by race. It is clear to see that the number of observations per race varies disproportionately. There is potentially too little variation of Whites and Coloureds in the sample to identify an effect, or that could imply a non random representation of the population at large. The results of any analysis would be unreliable or biased and could not be confidently extended to the population. The author was unable to find an alternative dataset with the relevant occupational break down shown here, and thus had to make use of this sample.

Table 2: Selection of Occupations by Race

Occupation	Blacks	Coloureds	Whites	Total	Proportion
Banksmen/ Onsetter	810	8	34	852	33.3%
Blaster	100	1	11	112	4.4%
Engine Driver	430	4	13	447	17.4%
Engineer	62	3	28	93	3.6%
Labourer	989	35	34	1,058	41.3%
Total	2,391	51	120	2,562	
Proportion	93.3%	1.99%	4.68%		

Source: Author's calculations using merged LFS and QLFS data sets.

Ordinal Probit Analysis

The dependent variable Ord_Occup_i is ordinal in nature taking integer values from 1 to 5 for each individual *i*. Using the International Socio-Economic Index of Occupational Status (ISEI) (Ganzeboom, De Graaf & Treiman, 1992)[20] that is discussed in Section 6 below, the occupations are ranked as follows: Labourer, Banksmen, Blaster, Driver and Engineer. The ordered probit model makes use of the rankings and determines the probability of an individual falling in one of the occupational ranks.

As the ordered rankings cannot be directly observed, the model makes use of a latent variable, $Ord\_Occup_i^*$, which is assumed to have a normal linear regression structure. That is:

$$Ord\_Occup_i^* = \beta_{0k} + \beta_t X_{it} + \varepsilon_{i1} \quad (1)$$

$$Ord\_Occup_i = 1 \text{ if } Ord\_Occup_i^* \leq \tau_1$$

$$Ord\_Occup_i = 2 \text{ if } \tau_1 < Ord\_Occup_i^* \; \tau_1 \leq \tau_2$$

...

$$Ord\_Occup_i = 5 \text{ if } Ord\_Occup_i^* \geq \tau_4$$

[20] It must be assumed that each race values the ranking system identically, that is that individuals with equal qualifications have identical preferences with regards to occupation choice, regardless of race.

where $\tau = (\tau_1, \dots, \tau_4)$ are cut off parameters derived from the data.

From Equation (1), a predicted $Ord\_Occup_i^*$ of less than τ_1 assigns an individual the Labourer occupation; the lowest attainable rank. As $Ord\_Occup_i^*$ increases, the occupations assigned move up in a stepwise fashion based on the predicted τ's.

The estimated probability function of Ord_Occup_i has the form:

$$prob(Ord\_Occup_i = 0) = \Phi(-\beta' X_{it})$$

$$prob(Ord\_Occup_i = 1) = \Phi(\tau_1 - \beta' X_{it}) - \Phi(-\beta' X_{it})$$

$$prob(Ord\_Occup_i = 2) = \Phi(\tau_2 - \beta' X_{it}) - \Phi(\tau_1 - \beta' X_{it})$$

...

$$prob(Ord\_Occup_i = 5) = 1 - \Phi(\tau_4 - \beta' X_{it})$$

where Φ represents the standard normal density.

From equation (1), X_{it} is a row of vectors constituting observable individual characteristics. They include race, age, age^2, age^3, highest level of education attained, categorical working experience levels, province, marital status, gender and year the individual was surveyed variables. Blacks with less than 5 years of working experience residing in Western Cape Province and with no education are used as the reference. β_t represent the estimated coefficients, while β_{0k} is the constant of each occupational level, k. The error term ε_{i1} is assumed to be normally distributed with a mean of zero and standard deviation of 1.

The ordinal probit regression is run to estimate the latent variable. It makes use of maximum likelihood estimators to determine the $\hat{\beta}$ coefficients. Robust standard errors are used to eliminate heteroskedasticity.

It should be noted, education plays a considerable role in occupational attainment. As a result, the quality of the institution attended adds to this determination (Murdoch, 2003), over and above the maximum years attained. Two general theories are postulated in literature explaining the source of the differential. The first is the human capital aspect generated by the quality of the teaching staff and resources available to develop students' hard and soft skills (Weiss, 1995; Murdoch, 2003). The second is the filtering or signalling feature, where the best quality institutions attract the inherently more skilled students, assuming away disparities in courses offered[21].

In an attempt to control for some of the unobservable school quality and by extension skill levels, the sample is further restricted to individuals that have not attained matriculation

[21] Macroeconomic conditions are known to affect an individual's decisions to work or study further (Dellas & Koubi, 2003; Hérault, Kostenko, Marks & Zakirova, 2012; Johnson, 2013). Adding logs of GDP growth rate (The World Bank, 2014) and Unemployment rates from 1994 (IMF, 2014) produced robust results that had marginally higher coefficients but identical significance.

certificates or higher[22]. With generally lower skill levels required and assumingly less of a signal to future employers, this limitation attempts to control for endogeneity attributable to omitted variable bias. However, due to no nationally standardized test offered before matriculation, teaching practices, curriculum and quality differ considerably among Primary and Secondary schools (Taylor, van der Berg & Burger, 2011). Therefore the model attempts to test if job reservation restrictions have persisted at lower levels of education and skill in the mining sector.

If the racial reservations have held, the following probabilities would be expected: Blacks would have the highest probability of being Labourers, while Whites and Coloureds would have higher probabilities with respect to Drivers, Blasters and Engineers. Whites would furthermore be expected to have the highest probability of being Banksmen/ Onsetters.

Table 3 below presents the predicted z scores that an individual will be employed in the five occupations. The standard errors of the estimates are displayed in parentheses alongside their p-values.

[22] With only 26 and 39 Coloureds and Whites respectively in this restricted sample, lack of variation is a concern, bringing the reliability of the results into question. Running the same regression over the entire sample space produces near identical results as shown in Table A5 in the Appendix with their marginal effects in Table A6. This suggests the limiting does little to control for skill level.

Table 3: Ordered Probit Regression on Occupational Attainment

Characteristic	Coefficient		Standard Errors	p-value
Race				
Coloured	-0.774	***	(0.228)	0.001
White	0.442	***	(0.107)	0.000
Education Level				
Some Primary	-0.043		(0.099)	0.659
Complete Primary	-0.058		(0.112)	0.602
Some Secondary	-0.024		(0.097)	0.801
Location				
Eastern Cape	-2.089	***	(0.795)	0.009
Northern Cape	-2.193	***	(0.699)	0.002
Free State	-1.443	**	(0.714)	0.043
Kwazulu-Natal	-1.972	***	(0.751)	0.009
North West	-1.691	**	(0.712)	0.018
Gauteng	-1.440	**	(0.714)	0.015
Mpumalanga	-1.839	***	(0.715)	0.010
Limpopo	-2.270	***	(0.714)	0.001
Demographics				
Age	0.288	***	(0.097)	0.003
Married	0.197	**	(0.077)	0.011
5 to 15 Years Experience	0.128		(0.107)	0.232
15 to 25 Years Experience	0.447	***	(0.124)	0.000
More than 25 Years Experience	0.354	***	(0.129)	0.006
Goodness-of-fit				
Log-likelihood	-2342.228			
Wald chi^2 with 20 df	433.19			
Pseudo R^2	0.0759			
N	2033			

Note: The regression contains Age^2, Age^3, Male and year of survey control variable as well. Robust standard errors are in parenthesis.

*Significant at the 10 % level

**Significant at the 5 % level

***Significant at the 1 % level

Source: Author's calculations.

The results show that at lower education levels, White's are more likely to be employed in higher skilled jobs than Blacks, unlike Coloureds who are less likely than Blacks. Both race variables are statistically significant at the 1% level.

Differing levels of education prove not to be statistically significant at these low levels. Increased experience nevertheless, raises the likelihood of being employed as Drivers and Engineers.

The marginal effects of the different races with respect to Blacks on the probability of being employed in particular occupations are shown in Table 4 below. These marginal effects signify the expected difference in probability between an average White or Coloured and a characteristically equivalent Black holding that job. Races not being considered at the time are set equal to 0, while all other variables are held at their means.

Table 4: Marginal Race Effects

Dependent Variable	**Labourer**	**Banksmen**	**Blaster**	**Driver**	**Engineer**
Predicted Probabilities					
P (Y=1|Black = 1)	0.384	0.401	0.041	0.166	0.008
P (Y=1|Coloured =1)	0.684	0.257	0.016	0.043	0.001
P (Y=1|White = 1)	0.231	0.405	0.055	0.285	0.025
Race Effect					
Coloured Effect	78.13%	-35.96%	-61.99%	-74.32%	-90.89%
White Effect	-39.98%	1.06%	32.84%	71.90%	207.60%

Notes: Other variables in regressions are taken at their means. These variables include Age, Age^2, Age^3, education, categorical experience levels, province, male and year.
Source: Author's calculations.

An average Coloured was 78.1% more likely to be a labourer than an equivalent Black, but on average about 65% less likely to hold all other occupations. Alternatively, an average White was 32.8%, 71.9% and 207.6%[23] more likely to be a Blaster, Driver and Engineer respectively than an observationally equivalent Black. Furthermore, an average White was negligibly more probable at being a Banksman and less than 40% likely to be a Labourer than a comparable Black.

To test for the robustness of these results, White and Lu's (2010) approach to identify core and non-core covariates that cannot and can be dropped respectively to obtain meaningful results was used. 128 different regressions were run for Equation 1 each with different

[23] There are only 14 Black and 4 White engineers with less than matriculation certificates.

combinations of variables producing consistent marginal race effects with identical signs for each occupation and race. The Coloured effects remained roughly 5 percentage points from those in Table 4, while White effects fluctuated considerably.

Assuming validity of the results, they suggest that the legislative colour bars passed in colonial and apartheid periods are not likely to have persisted to present day mining markets. Despite Whites showing a clear inclination towards higher skilled jobs after controlling for education and experience, Coloureds have in turn replaced Blacks in being employed in the least skilled occupations. This may allude towards some bias towards Whites being hired in more skilled jobs arising from the intergenerational transfers described in Section 3; however occupations are no longer fully aligned with the colour bars.

This could be attributed to changes in the definition of "skilled" and "unskilled" jobs due to proliferation of technology[24] as well as increased accessibility to education across all races[25]. As found in Mariotti (2011), economic incentives had already driven employers to hire Non-White races into semi skilled occupations at the height of the regulations. It can as a result be assumed that Blacks moved up the occupational ladder.

The change could also be attributed to the effect of Affirmative Action legislature. However, Burger and Jafta (2010) found that after 10 years the laws had at most had marginal effects on occupational attainment. Sallaz (2005) on the other hand, found that jobs in casinos had, in fact, been deskilled through installation of increased technology, thereby meeting BBBEE quota targets on employment, but not on share of power or skill.

Extreme caution would however be required before concluding a White bias in higher skilled jobs is inherent due to the data concerns mentioned above. The next section of the paper attempts to probe if a bias is experienced throughout the mining industry, and if so could it be fully explained by observable characteristics.

[24] From as early as 1905 mechanical drills mere introduced, followed by locomotives and mechanical scrapers in 1930s, then mechanical cactus grabs in the50s and mechanical loaders in the 60s (Wilson,2011: 84), that considerably transformed the working dynamics.

[25] After the first student enrolled in South African School of Mines in 1896, there had been 380 mining engineering graduates that had been produced by 1997 across the differing institutions with increasing Black enrolments (Phillips, 1999).

6 Decomposition of Occupational Rank

This section provides further empirical support to determine whether observable skill sets such as education and experience or other firm specific characteristics adequately explain the difference in occupational attainment between the three races. Failure to do so will imply that possible barriers remain in present day markets. In order to achieve this, the entire mining sample of 8,956 individuals is utilised. Furthermore, individual occupation data needs to be converted into a continuous scale variable allowing for such an analysis to be carried out, as seen in Mariotti (2011), and Burger and Jafta (2010).

A continuous scale allows infinite graded distinctions between occupations that are captured within a single parameter (Ganzeboom et al., 1992). Notwithstanding the loss in some information through this conversion, increased multivariate analysis is made capable.

Ganzeboom and Treiman (1996) highlight two skill based rankings that can be utilised in this conversion. The first is ISEI, developed by Ganzeboom et al. (1992), while the second is Standard International Occupational Prestige Scale (SIOPS) derived by Treiman (1977). Both rankings are derived from the International Standard Classification of Occupation 1988 (ISCO88) of the International Labor Office (ILO) which was the basis of SASCO, the criterion used to code occupation in the data sets.

The two rankings differ in their construction as follows; ISEI is a socioeconomic scale (SEO) created from weighted sums of numerous socioeconomic qualities such as level of education required, income and father's socioeconomic characteristics, calculated from 16 countries. While SIOPS is a prestige measure, obtained from popular beliefs of occupational status (Ganzeboom & Treiman, 1996). It was constructed from 60 separate prestige scales from 53 countries[26]. ISEI ranges from 16 to 88 whilst SIOPS ranges from 13 to 78 in the data set.

Whereas SEO scales are based on credible criterion on educational requirements, income and the like, prestige scales lack the criterion validity and are biased towards their countries/cultures of origin (Yogev, 1980; Stewart, 1983). Ideally to ensure compatibility, surveys should be run to certify the scales are significantly correlated to your subject sample (Yogev, 1980). However, such validation tests fall out of the scope of this thesis and as a result SIOPS output is included simply as a rough robustness check with its output obtainable in the Appendix[27].

Table 5 below illustrates the average occupational rankings by race. Whites on average have the highest mean of both ranks followed by Coloureds then Blacks.

[26] 11 of which were from Africa, 15 from Western Europe, 17 from Asia and Oceania, 13 From Latin America and the Caribbean (Yogev, 1980)

[27] ISEI and SIOPS have a correlation of 0.8938 in the data set.

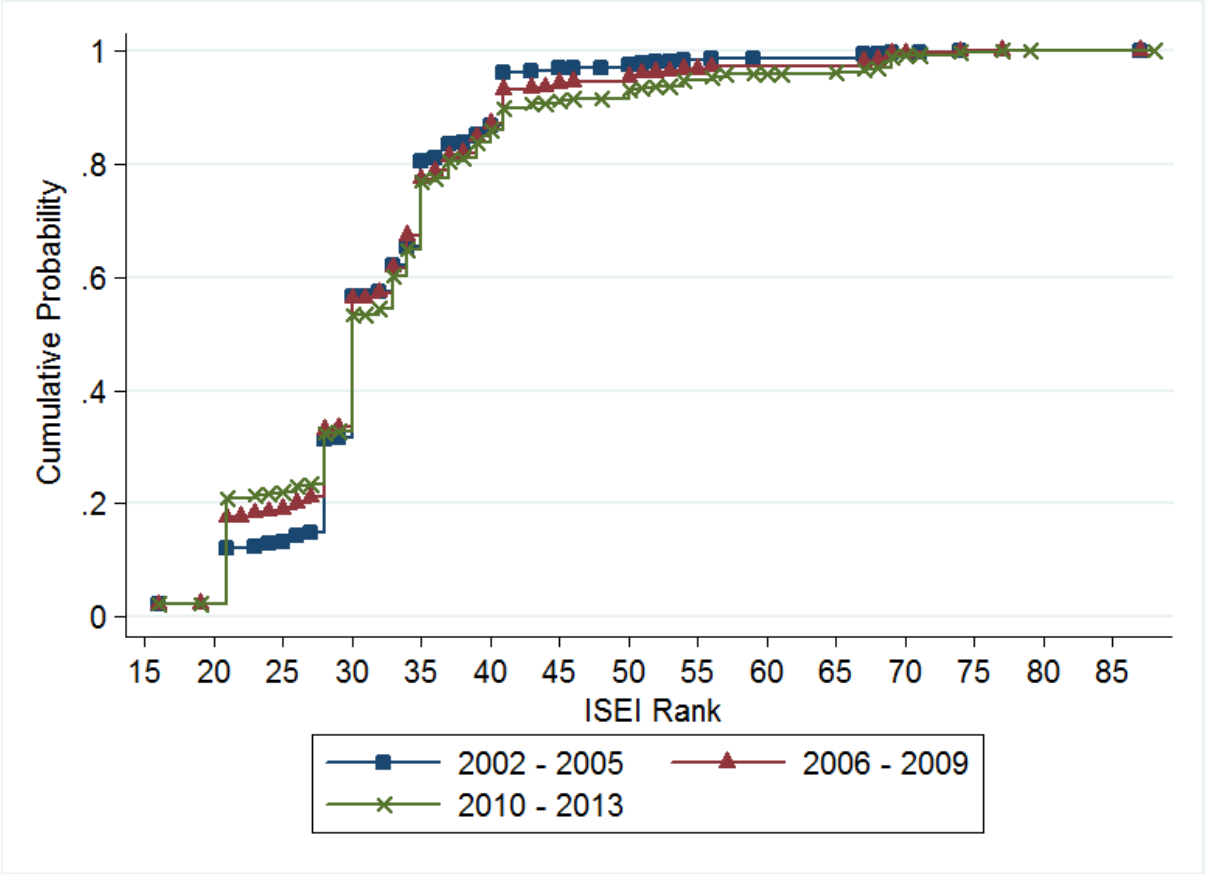
Table 5: Average Occupation Ranks by Race

Race	Black	Coloured	White
Average ISEI	32.347	34.913	41.406
Average SIOPS	33.297	35.034	42.045

Source: Author's calculations.

Figures 1, 2 and 3 extend the breakdown of the occupational rank by considering the movements across the years exhibited by each race. Each graph depicts the cumulative distribution plots for the years 2002 to 2005, 2006 to2009 and 2010 to 2013.

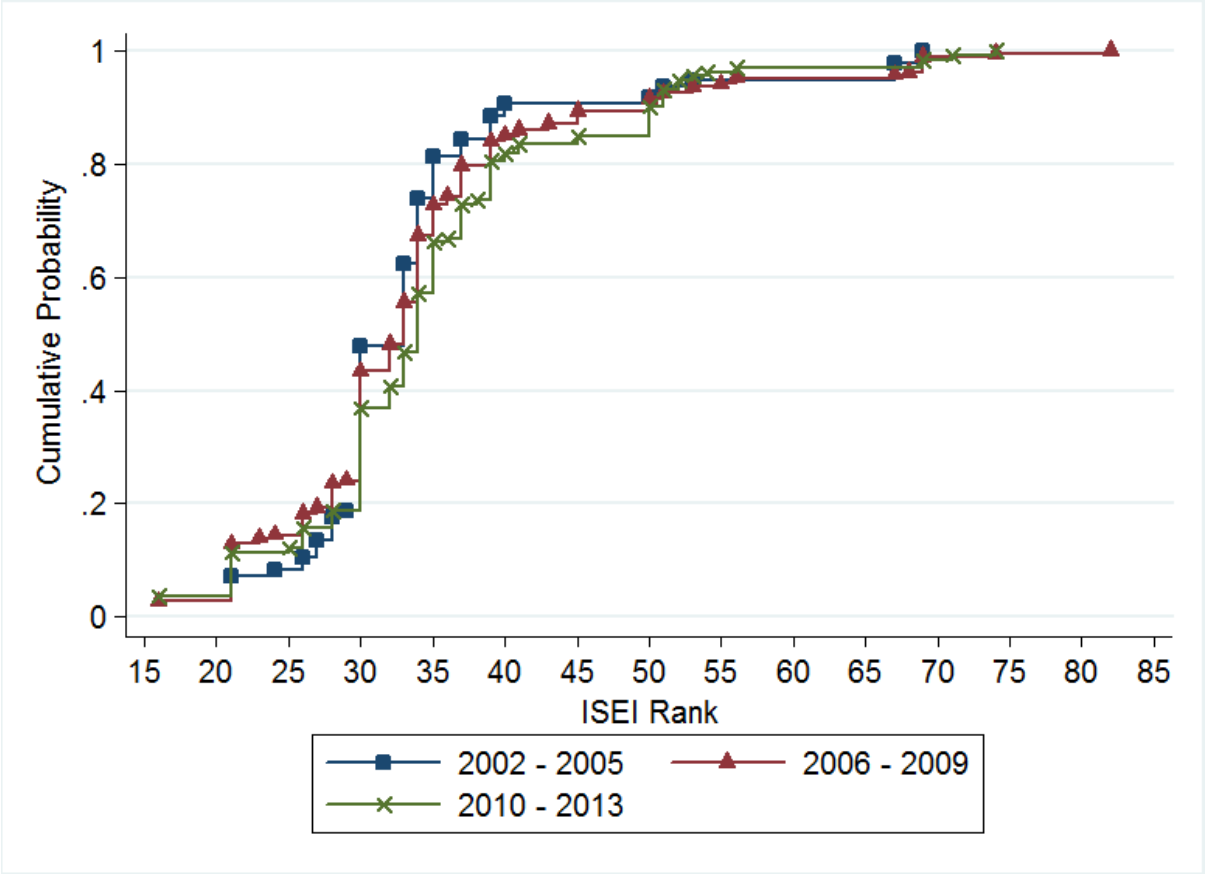
Figure 1: Cumulative Distribution of Black ISEI rank



Source: Author's calculations.

Figure 1 shows there has been some movement between occupations by Blacks, especially at the extremes. Specifically, there has been an increase in their proportion of employment at the lowest and highest ranked occupations. This shift seems to corroborate Section 5's findings in that Blacks have increased their occupational skill level surpassing the Coloureds in a number of them. In addition, there have been those that have benefited at the top level (Crankshaw, 2012). The middle of the range of ranks seems to have remained relatively similar.

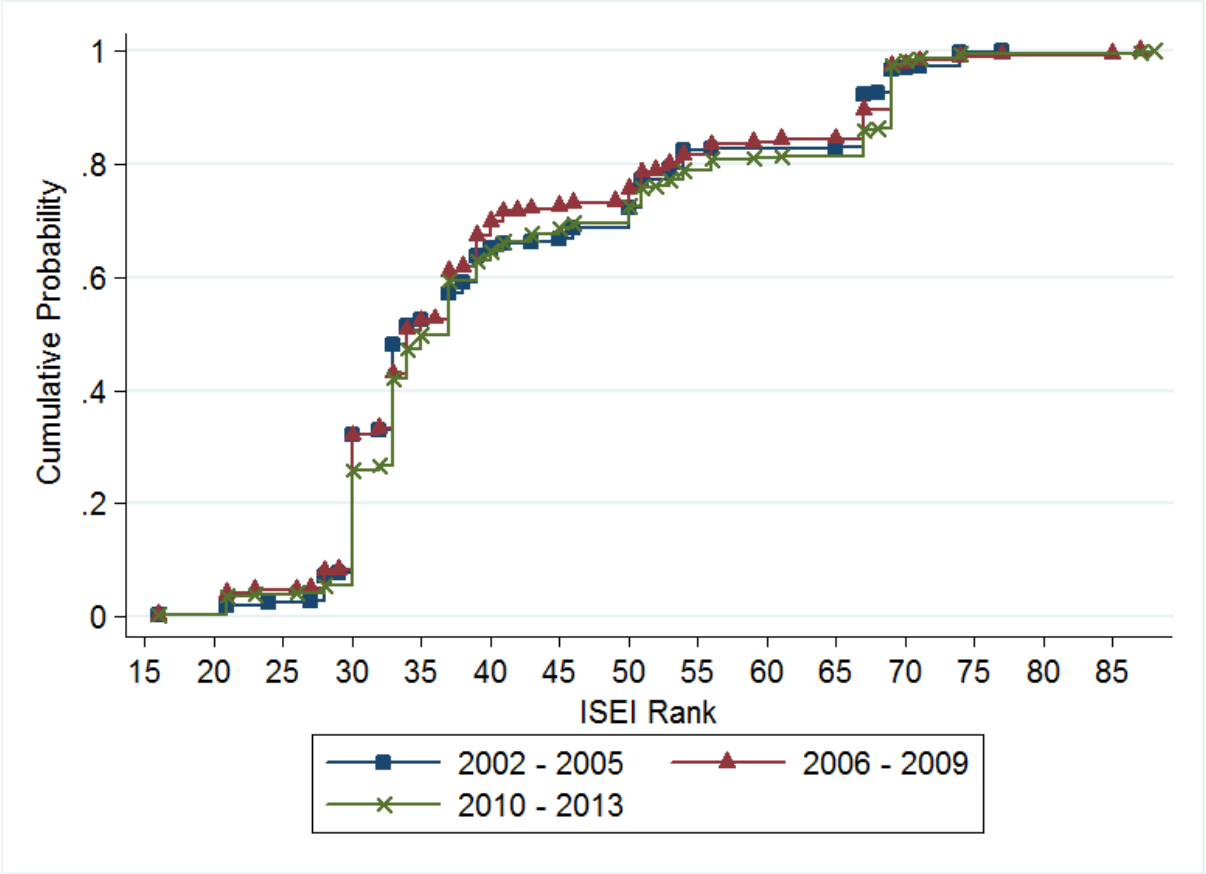
Figure 2: Cumulative Distribution of Coloured ISEI rank



Source: Author's calculations.

According to Figure 2 above, Coloureds have had increased proportions employed in the lower ranks, and fewer employed in the highest ranks as the years have progressed. This appears to agree with the earlier findings that Coloureds held the lowest occupation levels among the races. Across the middle range there, however, seems to have been upward mobility demonstrated.

Figure 3: Cumulative Distribution of White ISEI rank



Source: Author's calculations.

There has not been much movement along the decade for Whites as noted in Figure 3. Between 2006 and 2009 there was a general drop in employment rank level. It however regained its initial 2002 to 2005 levels. The extremes have remained relatively unchanged.

Observable Skill Sets

There has been a general convergence of education levels between the races over the years (Burger & Jafta, 2010; Keswell, Girdwood & Leibbrant, 2011). Driven by full access to education for all and Whites not being able to increase their levels much further, these convergences have had a substantial effect in closing the occupation gap (Burger & Jafta, 2010). However, the general level of Black education remains considerably low.

Void of restrictive employment and education regulations in addition to equal payment to all races at a particular occupation, job attainment would be expected to be related to the inherent skill of the potential employees. Consequently considering educational attainment may explain the disparities among the races occupational levels.

Educational attainment cannot be summed entirely by number of years of schooling. The quality offered is equally important. Across the country the quality of education offered has remained polarised on provincial, socio-economic and institutional (that is between formerly White and Black schools) lines (Spreen & Vally, 2006; Leibbrandt, Woolard, McEwen & Koep, 2009; Taylor et al., 2011). Although non-personnel public spending is well-targeted, such that the poorest fifth of schools receive roughly six times higher than the richest fifth of schools; schools in better off communities remain superiorly resourced due to being able to charge fees (Taylor et al., 2011).

As stated in Section 5, the quality differential translates to differentiated outcomes. Van der Berg et al. (2011) found that by the age of eight there already existed large performance gaps between school children in the top 20% of the population and the rest. This highlighted the potential distinctions at such early ages.

Coupled with socio-economic and environmental factors, children's cognitive skills development proves more complex than simply the maximum number of school years. With the dataset not allowing controlling for quality related measures, true causation will be difficult to ascertain.

On average Blacks maximum educational attainment in the sample was Grade 9, followed by Coloureds with Grade 11 and Whites successfully achieving Matriculation certificates. Table 6 further shows the proportional break down of the highest attained level of education by race.

Table 6: Highest Level of Education as a Proportion of Each Race (%)

Education	Black	Coloured	White
No Schooling	7.09	2.51	1.90
Some Primary	17.87	5.92	0.07
Complete Primary	8.33	5.24	0.29
Some Secondary	35.52	36.08	23.50
Grade 12/ Std 10	23.83	34.17	45.39
Higher	7.36	17.08	28.84

Note: Higher includes diplomas or certificates with Matriculation certificates, degrees, postgraduate degrees or diplomas
Source: Author's calculations.

Table 7: Average Education by Race

Race	Black	Coloured	White
Average	9.76	11.58	13.16
Std. Dev	(3.838)	(2.982)	(1.503)

Notes: Education is a variable denoting maximum level of education attained, coded in the following manner: 0: no schooling, 1 – 12: Primary school, 13: Grade 12/Matriculation/NTC III, 14: Certificates or Diplomas without Grade 12 and 15: any Higher education.

Source: Author's calculations.

To investigate the significance of educational attainment and experience in determining the level of skill of the occupation employed in, ordinary least squares (OLS) is utilized. Each race is modelled separately to determine the differing returns to education and experience. The regression model used is as follows:

$$Occuprank_h = \beta_0 + \beta_1 educagr_i + \beta_2 X_i + \varepsilon_i \ \ if \ race = 1 \qquad (2)$$

where $Occuprank_h$ is the occupational index being analysed, $educagr_i$is the maximum education attained, X_i is a vector of individual as well as industry[28] and employer characteristics, $race$ is a dummy variable for each ethnic group and ε_i is the random error term. Robust standard errors are used and reported in parenthesis in Tables 8[29].

[28]The different industries within the mining sector are coal and lignite, gold and uranium ore, metal ores, iron ores, non-ferrous metal ores, mining and quarrying, stone quarrying clay and sandpits, diamond, mining and quarrying not elsewhere classified, service activities incidental to mining of minerals and extraction of crude petroleum and natural gas and the services related.

[29] SIOPS output can be found in Table A1 in the Appendix.

Table 8: Effect of Educational Attainment in Determining ISEI index

Characteristic	Black		Coloured		White	
Education Level						
Some Primary	-0.142		-0.278		10.406	***
	(0.415)		(1.935)		(3.116)	
Complete Primary	0.131		-1.912		-8.737	***
	(0.467)		(1.895)		(3.041)	
Some Secondary	0.908	**	1.784		-7.493	***
	(0.487)		(1.800)		(2.816)	
Grade 12/ Std 10	2.926	***	3.473	*	-3.535	
	(0.487)		(1.933)		(2.800)	
Higher	13.053	***	12.319	***	6.583	**
	(0.824)		(2.360)		(2.889)	
Experience						
5 to 15 Years Experience	0.455		-0.604		0.323	
	(0.394)		(1.418)		(1.110)	
15 to 25 Years Experience	1.602	***	-0.626		0.547	
	(0.454)		(1.826)		(1.277)	
More than 25 Years Experience	1.366	***	-1.962		3.126	**
	(0.472)		(2.092)		(1.513)	
Demographics						
Age	0.020		-0.023		0.076	**
	(0.014)		(0.061)		(0.038)	
Married	0.675	**	2.272	*	1.237	
	(0.289)		(1.171)		(0.977)	
Male	0.566		-1.698		-6.641	***
	(0.500)		(1.586)		(0.988)	
Firm Characteristics						
Industry and Medical	Yes		Yes		Yes	
Constant	26.820	***	28.033	***	44.168	***
	(0.939)		(4.906)		(3.401)	
R^2	0.123		0.227		0.209	
N	7095		431		1348	

Note: Each regression contains marital status, gender, industry and medical care or health insurance variables. Robust standard errors are in parenthesis.

*Significant at the 10 % level

**Significant at the 5 % level

***Significant at the 1 % level

Source: Author's calculations.

From the estimation, increased education has a higher return for Blacks than any other race. This is possibly driven by the low educational base intrinsic with Blacks, where companies are quick to hire educated Blacks, especially to fill BBBEE positions (Sallaz, 2005). Blacks were in addition rewarded further for less than 25 years of experience, while Whites were rewarded more for over 25 years.

It should be noted that for Whites the achievement of a maximum of completed Primary, some Secondary and completed Matriculation had negative and significant (save for Matriculation) effects on ISEI (and SIOPS) index. Weiss (1995) proposed that high ability individuals who gain more from schooling and value future earnings essentially would stay in school longer. With Whites generally being more educated, those not achieving higher education are generally of lower ability, thus lower ranking jobs. Furthermore, older White generations in the dataset are more likely to be higher educated than younger generations, with Blacks experiencing the reverse. This could be showing the remnant bias from older generations, versus the current skill based employment in younger generations. Dropping firm and industry level variables produced consistent results as shown in Appendix A4.

Oaxaca Decomposition

The results above can be used to separate the average ISEI gap between races into explained and unexplained portions. This is achieved using a variant of Oaxaca wage decomposition (1973) as displayed in Mariotti (2011) where she derives the explained and unexplained difference between African and White occupation ranks in South Africa in 1970 and 1980, as well as Stewart (1983) who compares average hourly earnings between White United Kingdom born individuals and Black immigrants.

With no discrimination in the labour market, each race would be on average able to achieve equivalent rankings of occupation given a particular characteristic traits (Oaxaca, 1973), which would manifest in similar coefficients in Equation (2). The decomposition uses this premise by inserting the average characteristics of one race into the predicted coefficients of Equation (2) of another race and examining the disparity.

The following equation breaks down the difference in average occupational rank, $Occuprank_l$, into an explained and unexplained part.

$$Occuprank_l - Occuprank_k = f_l(\overline{X_l}) - f_k(\overline{X_k}) \quad (3)$$
$$= [f_l(\overline{X_l}) - f_l(\overline{X_k})] + [f_l(\overline{X_k}) - f_k(\overline{X_k})]$$

Where

$f_l(\,)$ and $f_k(\,)$ are the functions of race *l* and *k* from Equation (2), that is the vector of coefficients derived from running the regressions.

$\overline{X_l}$ and $\overline{X_k}$ are vectors of mean values for the variables in Equation (2) for the two comparison races.

And therefore $f_l(\overline{X_k})$ is a function determining what the Occupational rank of race *k* would be if a member of that race was exposed to the same market structure as race *l* experiences. This is ordinarily not observable.

The first set of brackets in (3) produces the explained component of the difference in average occupational rankings, while the second shows the unexplained portion. The results of this decomposition are presented in Table 9[30].

Table 9: Oaxaca Decomposition of Average ISEI gap with Explained and Unexplained Percentage of Occupational Rank

Races Compared	% Explained	% Unexplained
Black - Coloured	60.51	39.49
Black - White	41.94	58.05
Coloured - White	24.91	75.09

Source: Author's calculations.

A large portion of the difference between the races occupational attainment cannot be explained by the model. Black and Coloured gaps are mostly explained at 60.5% by education, experience, demographic and firm specific details. The discrepancy between Whites and the other races proves more difficult to explain. 58.1% and 75.1% remains unexplained between Blacks and Coloureds, respectively.

Dropping industry and firm level variables increases the explained difference between Coloured and Whites to over 40%. This however drops the explained part of Black – Coloured gap to 47.2%, and Black – White gap to 39.3%.

[30] SIOPS occupational gap analysis can be found in Table A2 in the appendix.

Table 10: Oaxaca Decomposition with no Industry or Firm Variables of Average ISEI gap with Explained and Unexplained Percentage of Occupational Rank

Races Compared	% Explained	% Unexplained
Black - Coloured	47.15	52.85
Black - White	39.30	60.70
Coloured - White	42.91	57.09

Source: Author's calculation.

These results might suggest that there could still be some skill based discrimination present in the mining labour sector that has been propagated through intergenerational transfers after the repealing of the colour bars. However, various other observationally equivalent causal representations go untested thus requiring caution in making such a conclusion.

As mentioned above, the education variable used in the dataset ignores its quality, which would serve to more effectively describe the returns to education. Variables relating to school and teacher characteristics would shed light on this.

In addition, Government policies such as the Skills Development Act mentioned in Section 2 above, could be causing significant skews in the lower education levels through their development and education platforms. Despite these programmes having direct effects on employment, they may not register as education in the dataset as only diplomas or certificates that last at least 6 months are recorded (StatsSA, 2013).

Further still, factors such as ambition and childhood influences like socio-economic background affect how well a student does in school, as well as the jobs sought after (Brown, Moon & Zoloth, 1980; Taylor et al., 2011).

Crankshaw (2012) describes Whites as having urbanized much earlier than other races and therefore were able to take advantage in the growth in demand for high-skilled and managerial occupations. Non-Whites having been the last to migrate into urban towns would therefore have significantly lower skills and as a result lower ranked occupations.

Furthermore, the remote sites of many mines might affect the employment decisions differently with each race. For example, Coloureds who are situated more in the Western Cape where few mines exist may not be willing to migrate higher North to work in the mines.

It is important to note as well that this analysis considers only individuals that are already part of the labour force. There could potentially be significantly more bias between those applying for the same post and not getting them.

Nevertheless, it is clear that considerable caution has to be placed on the educational systems in the country to increase general level of education and quality.

7 Conclusion

This paper set out to determine if job reservations had persisted in the present day mining sector by first tracing the source and development of the colour bars from the colonial era to their eventual abolition in 1879.

Focussing on four occupations frequently cited in the draconian legislation; Banksman, Blaster, Winding Engine Driver and Engineer, as well as a representative unskilled occupation, Labourer, ordered probit regressions were run to test the hypothesis. There was little evidence found supporting their persistence. This came as no surprise with developments in technology that have changed the definition of skill.

Despite controlling for skill by focussing on those with a lower than matriculation education, Whites were found to have a bias towards higher skilled jobs. Using an Oaxaca decomposition, the paper then set out to determine if this bias was present throughout the mining industry. This was achieved by considering how much of the average difference in occupational gaps could be explained by observable skill sets.

A large portion of the gap especially between Whites and the other races (58.1% with Blacks and 75.1% with Coloureds) could not be explained. This implied either there was still some skill based discrimination or the model was unable to pick up other observable and unobservable characteristics explaining occupational attainment. Without adequate controls in the dataset such as education quality and the individual's socio-economic background, a skill based causal discrimination cannot be confidently concluded.

This paper's analysis could be improved if datasets on the Certificates of Competency related to the occupations analysed could be retrieved from the Department of Mineral Resources (DMR), added with greater specification of educational quality. In addition, running surveys to adjust the prestige scale, SIOPS, to ensure higher correlation with actual South Africans would improve the accuracy of the results.

There appears to be a divide between policy rhetoric and actually reality on the ground with regards to Affirmative Action measures (Sallaz, 2005; Burger & Jafta, 2010). This means that numerically those previously disadvantaged are meeting the hiring quota, but in effect not sharing the power or skill level. Different policies should be identified to attempt to redress this further.

References

Alexander, R. & Simons, H. J. 1959. *Job Reservation and the Trade Unions.* Cape Town, South Africa: Enterprise. 3 – 6.

Acemoglu, D., Johnson, S. & Robinson, J. A. 2002. Reversal of Fortune: Geography and Institutions in the Making of the Modern World Income Distribution. *The Quarterly Journal of Economics.* 117 (4): 1231 – 1294.

Arcand, J.L. & D'Hombres, B. 2004. Racial Discrimination in the Brazilian Labour Market: Wage, Employment and Segregation Effects. *Journal of International Development.* 16: 1053-1066.

Bantu Education Act. No 47 of 1953. 1953. *Government gazette.*

Beaman, L., & Magruder, J. 2012. Who Gets the Job referral? Evidence from a Social Network Experiment. *American Economic Review.* 102(7): 3574-3593.

Björklund, A. & Jäntti, M. 2009. Intergenerational Income Mobility and the Role of Family Background. *The Oxford Handbook of Economic Inequality*. Oxford: Oxford University Press.

Broad-Based Black Economic Empowerment Act, No. 53 of 2003, 2004. *Government gazette* .463(25899). 9 January. Government notice no. 17. Cape Town: Government Printer.

Brown, R. S., Moon, M. & Zoloth, B. S. 1980. Incorporating Occupational Attainment in Studies of Male – Female Earnings Differentials. *The Journal of Human Resources.* 15 (1): 3 – 28.

Burger, R. & Jafta, R. 2010. Affirmative Action in South Africa: an Empirical Assessment of the Impact on Labour Market Outcomes. *Centre for Research on Inequality, Human Security and Ethnicity* working paper no. 76. Oxford: CRISE, University of Oxford. Available: http://r4d.dfid.gov.uk/pdf/outputs/inequality/workingpaper76.pdf. [2014, February 10]

Chamber of Mines of South Africa. n.d. Available: http://www.bullion.org.za/content/?pid=69&pagename=Skills+Development. [2013, December 25]

Chamber of Mines of South Africa. 2013. Facts and Figures 2012. Available: http://www.bullion.org.za/documents/Chamber%20facts%20and%20figures%202013.pdf. [2014, January 5]

Competition Act, No. 35 of 1999. 1999. *Government gazette.*

Corak, M. 2013. Income Inequality, Equality of Opportunity, and Intergenerational Mobility. Forthcoming in *Journal of Economic Perspectives.*

Crankshaw, O. 2012. Deindustrialization, Professionalization and Racial Inequality in Cape Town. *Urban Affairs Review*. 48(6): 836-862.

Darden, J. 2005. Black Occupational Achievement in the Toronto Census Metropolitan Area: Does Race Matter? *The Review of Black Political Economy.* 33 (2): 31 – 54.

Deindustrilization, Professionalization and Racial Inequality in Cape Town. *Urban Affairs Review*. 48 (6): 836 – 862.

Dell, M. 2010. The Persistent Effect of Peru's Mining Mita. *Econometrica.* 78 (6): 1863 – 1903.

Dellas, H. & Koubi, V. 2003. Business Cycles and Schooling. *European Journal of Political Economy.* 19: 843 – 859.

Doxey, G. V. 1961. *The Industrial Colour Bar in South Africa.* London: Oxford University Press.

Eberharter, V. V. 2006. Traditional Family Role Patterns and the Intergenerational Transmission of Occupational Status – Germany and the United States Compared.

Employment Equity Act, No. 55 of 1998, 1998. *Government gazette*. 400(19370). 19 October. Government notice no. 1323. Cape Town: Government Printer.

Extension of University Education Act, No. 45 of 1959, 1959. *Government gazette.*

Extension of University Education Act, No. 32 of 1960, 1960. *Government gazette.*

Extension of University Education Act, No. 67 of 1963, 1963. *Government gazette.*

Ganzeboom, H. B. G., De Graaf, P. M. & Treiman, D. J. 1992. A Standard International Socio-Economic Index of Occupational Status. *Social Science Research.* 21: 1 – 56.

Ganzeboom, H. B. G., & Treiman, D. J. 1996. Internationally Comparable Measures of Occupational Status for the 1988 International Standard Classification of Occupations. *Social Science Research.* 25: 201 – 239.

Gardner, J. 1990. The Rise and Fall of the South African Industrial Colour Bar. *Economic Affairs.*10 (5): 19 – 23.

Gaskin, D. J., Headen, Jr., A. E., & White-Mean, S. I. 2005. Racial Disparities in Health and Wealth: The Effects of Slavery and Past Discrimination. *Review of Black Political Economy.* 32(3/4): 95 – 110.

Greene, W. H. 2011. LIMDEP Version 9 Student Reference Guide. *Econometric Software, Inc.* USA. Available: http://pages.stern.nyu.edu/~wgreene/DiscreteChoice/Software/LIMDEP-Short-Student-Manual.pdf. [2014, February 10]

Hellerstein, J. K., & Morrill, M., S. 2011. Dads and Daughters the Changing Impact of Fathers on Women's Occupational Choices. The *Journal of Human Resources.*46 (2): 333- 372.

Hérault, N., Kostenko, W., Marks, G. & Zakirova, R. 2012. The Effects of Macroeconomic Conditions on the Education and Employment Outcomes of Youth. *Australian Journal of Labour Economics.* 15 (2): 17 – 36.

Industrial Conciliation Act, No. 11 of 1924. 1924. *Government gazette.*

Industrial Conciliation Act, No 28 of 1956, 1956. *Government gazette.*

Industrial Conciliation Amendment Act, No 94 of 1979, 1979. *Government gazette.*

International Monetary Fund, 2014. South African Data Set [dataset]. Washington, DC.: International Monetary Fund [producer].

Johnson, M. T. 2013. The Impact of Business Cycle Fluctuations on Graduate School Enrolment. *Economics of Education Review.* 34: 122 -134.

Kalev, A., Dobbin, F. & Kelly, E. 2006. Best Practices or Best Guesses? Assessing the Efficacy of Corporate Affirmative Action and Diversity Policies. *American Sociological Review.* 71: 589 – 617.

Kasteridis, P. P., Munkin, M. K. & Yen, S. T. 2010. Demand for Cigarettes: A Mixed Binary-Ordered Probit Approach. *Applied Economics.* 42 (4 -6): 413 – 426.

Katz, E. N. 1999. Revisiting the Origins of the Industrial Colour Bar in the Witwatersrand Gold Mining Industry, 1891-1899. *Journal of Southern African Studies.* 25(1): 73-97.

Keswell, M., Girdwood, S. & Leibbrandt, M. 2011. Educational Inheritance and the Distribution of Occupations: Evidence from South Africa. *Southern Africa Labour and Development Research Unit* working paper series no. 73. Cape Town: SALDRU, University of Cape Town. Available: http://www.opensaldru.uct.ac.za/bitstream/handle/11090/166/2012_73.pdf?sequence=1. [2014, February 07]

Knudsen, E., Heckman, I., Cameron, J. & Shonkoff, J. 2006. Economic, neurobiological, and behavioral perspectives on building America's future workforce. *National Academy of Sciences of the United States of America* July, 103(27).

Krueger, A. 2012. "The Rise and Consequences of Inequality." Presentation made to the *Center for American Progress,* January 12th. Available: http://www.americanprogress.org/events/2012/01/12/17181/the-rise-and-consequences-of-inequality/. [2013, August 18]

Kurtulus, F., A. 2011. The Impact of Affirmative Action on the Employment of Minorities and Women over Three Decades: 1973-2003. *Department of Economics.* University of Massachusetts Amherst.

Leonard, J., S. 1990. The Impact of Affirmative Action Regulation and Equal Employment Law on Black Employment. *Journal of Economic Perspectives.* 4(4): 47-63.

Leibbrandt, M., Finnd, A., & Woolard, I. 2012. Describing and decomposing post-apartheid income inequality in South Africa. *Development Southern Africa.* 29(1): 19 -34.

Leibbrandt, M., Woolard, I., McEwen, H. & Koep, C. 2009. Employment and Inequality Outcomes in South Africa. *Southern African Labour and Development Research Unit.* University of Cape Town.

Long, M. C. 2007. Affirmative Action and Its Alternatives in Public Universities: What do We Know? *Public Administration Review*. 67 (2): 315 - 330.

Mariotti, M. 2011. Labour markets during apartheid in South Africa. *Economic History Review*. 65 (3): 1110 – 1122.

Master & Servant Ordinance No 1 of 1841, 1841. Available: http://www.nelsonmandela.org/omalley/index.php/site/q/03lv01538/04lv01646/05lv01668.htm. [2013, August 18]

Masters & Servants Act No 15 of 1856, 1856. Available: http://www.nelsonmandela.org/omalley/index.php/site/q/03lv01538/04lv01646/05lv01672.htm. [2013, August 18]

Miller, A. R., & Segal, C. 2011. Does Temporary Affirmative Action Produce Persistent Effects? A Study of Black and Female Employment in Law Enforcement. *Review of Economics and Statistics.*

Mines and Works Act, No. 12 of 1911. 1911. *Government gazette.*

Mines and Works Amendment Act, No. 25 of 1926, 1926. *Government gazette.*

Mines and Works Amendment Act, No. 27 of 1956, 1956. *Government gazette.*

Mine Health and Safety Act, No. 29 of 1996. *Government gazette.*14 June. Government notice no. 17242.

Mining Qualifications Authority. Annual Reports from 2003 to 2012. Available: http://www.mqa.org.za/content.asp?subID=12. [2014, January 10]

Montgomery, J., D. 1991. Social Networks and Labor-Market Outcomes: Toward an Economic Analysis. *American Economic Review:* 81(5): 1407- 1418.

Munshi, K. 2003. Networks in the Modern Economy: Mexican Migrants in the U.S Labor Market. *The Quarterly Journal of Economics.*118 (2): 549-599.

Murdoch, J. 2003. Institutional Effects on Graduate Employment: a Comparison across Six European Countries and Japan. *International Congress for School Effectiveness and Improvement*: IREDU, University of Bourgogne.

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

Philips, H. R. 1999. Mining Education in South Africa – Past, Present and Future. *The Canadian Mining and Metallurgical Bulletin.* 92 (1032): 97 – 102.

Preferential Procurement Policy Framework Act, No 5 of 2000. 2000. *Government gazette.*

Ranchod, V. & Dinkelman, T. 2008. Labour Transitions in South Africa: What can we Learn from Matched Labour Force Survey Data? *Southern Africa Labour and Development Research Unit* working paper series no. 14. Cape Town: SALDRU, University of Cape Town.

Roback, J. 1988. W. H. Hutt's The Economics of the Colour Bar. *Managerial and Decision Economics.* 9: 65 – 70.

Sallaz, J. J. 2005. "It's an Empowerment Thing": an Ethnography of Colour Bar Conservation in a South African Service Industry. *Society in Transition.* 36(1): 38 – 56.

Skills Development Act, No. 97 of 1998. *Government gazette.* 40. 2 November. Government notice no. 19420. Cape Town: Government Printer.

Slavery Abolition Act of 1833, 1833. (United Kingdom) Available: http://www.irishstatutebook.ie/1833/en/act/pub/0073/print.html. [2013, October 10]

Simons, H. J. 1961. Death in South African Mines. *African South*: 5(4). 41- 55.

Simons, J. H., & Simons, R. E. 1983. Class and Colour in South Africa 1850 – 1950. South Africa: Shadowdean Ltd. 73 -97.

South Africa. The Truth and Reconciliation Committee. 1998. Truth and Reconciliation Commission of South Africa Report. Vol 1.

South African History Online, 1867. Available: http://www.sahistory.org.za/dated-event/first-recorded-discovery-diamonds-colonial-period-south-africa. [2014, January 20].

South African History Online. n.d. Available: http://www.sahistory.org.za/politics-and-society/apartheid-legislation-1850s-1970s. [2013, August 17].

Spreen, C. A. & Vally, S. 2006. Education Rights, Education Policies and Inequality in South Africa. *International Journal of Educational Development.* 26: 352 -362.

Statistics South Africa, 2001. Census 2001 [Raw data]. Available: DataFirst database [2013, September 18].

Statistics South Africa. Labour Force Survey 2000 – 2007 [dataset]. Pretoria: Statistics South Africa [producer]. Cape Town: DataFirst [distributor].

Statistics South Africa. Labour Force Metadata Survey 2000 – 2007. Pretoria: Statistics South Africa [producer]. Cape Town: DataFirst [distributor].

Statistics South Africa. Quarterly Labour Force Survey 2008, Q1 – 2013, Q4 [dataset]. Pretoria: Statistics South Africa [producer]. Cape Town: DataFirst [distributor].

Statistics South Africa. Quarterly Labour Force Survey Metadata 2008, Q1 – 2013, Q4. Pretoria: Statistics South Africa [producer]. Cape Town: DataFirst [distributor].

Stewart, M. B. 1983. Racial Discrimination and Occupational Attainment in Britain. *The Economic Journal.* 93: 521 – 541.

Taylor, S., van der Berg, S. & Burger, 2011. R. Low Quality Education as a Poverty Trap in South Africa. *Programme to Support Pro- Poor Policy Development*: PSPPD, University of Stellenbosch.

The World Bank, 2014. South African Data Set [dataset]. Washington, DC.: The World Bank [producer].

Treiman, D. J. 1977. Occupational Prestige in Comparative Perspective. *Academic Press.* New York.

Van der Berg, S., Burger, C., Burger, R., de Vos, M., du Rand, G., Gustafsson, M., Moses, E., Shepherd, D. et al. 2011. Low Quality Education as a Poverty Trap. *Programme to Support Pro- Poor Policy Development:* PSPPD, University of Stellenbosch.

Wage Act, No. 27 of 1925. 1925. *Government gazette.*

Webster, E. & von Holdt, K. 2005. *Beyond the Apartheid Workplace: Studies in Transition.* South Africa, Scottsville.

Weiss A. (1995), Human Capital vs. Signalling Explanations of Wages, *Journal of Economic Perspectives.* 9 (4): 133-154.

White, H. & Lu, X. 2010. Robustness Checks and Robustness Tests in Applied Economics. *Journal of Econometrics.* 178 (1): 194 – 206.

Wilson, F. 2011. Labour in the South African Gold Mines 1911 – 1969. *Cambridge University Press.* United States of America.

Yogev, A. 1980. Validating the Applicability of the Standard International Occupational Prestige Scale: Illustrations from Costa Rica and Israel. *International Review of Modern Sociology.* 10 (1): 15 – 35.

Appendix

Table A1: Effect of Education Attainment in Determining SIOPS index

Characteristic	Black		Coloured		White	
Education Level						
Some Primary	-0.000		4.573	**	8.589	***
	(0.448)		(2.192)		(2.568)	
Complete Primary	0.559		-0.214		-5.040	
	(0.500)		(2.158)		(3.257)	
Some Secondary	0.844	*	3.359	*	-6.938	***
	(0.437)		(1.874)		(2.349)	
Grade 12/ Std 10	2.611	***	5.812	***	-4.158	*
	(0.491)		(1.993)		(2.326)	
Higher	12.079	***	13.604	***	3.216	
	(0.748)		(2.203)		(2.373)	
Experience						
5 to 15 Years Experience	0.736	*	0.033		-0.053	
	(0.394)		(1.255)		(0.893)	
15 to 25 Years Experience	2.400	***	-0.820		-0.171	
	(0.449)		(1.680)		(1.004)	
More than 25 Years Experience	2.160	***	-0.319		0.737	
	(0.467)		(1.832)		(1.196)	
Demographics						
Age	0.002		-0.000		0.080	***
	(0.014)		(0.058)		(0.029)	
Married	1.013	***	0.915		1.299	*
	(0.290)		(1.149)		(0.784)	
Male	1.273	***	1.910		-2.374	***
	(0.460)		(1.211)		(0.795)	
Firm Characteristics						
Industry and Medical	Yes		Yes		Yes	
Constant	27.489	***	24.299	***	43.414	***
	(0.925)		(4.164)		(2.793)	
R^2	0.117		0.243		0.163	
N	7095		431		1348	

Note: Each regression contains year started employment, married, male, industry and medical care variables. Robust standard errors are in parenthesis.

*Significant at the 10 % level
**Significant at the 5 % level
***Significant at the 1 % level

Sourced: Author's calculations.

Table A2: Oaxaca Decomposition of Average SIOPS gap with Explained and Unexplained Percentage of Occupational Rank

Races Compared	% Explained	% Unexplained
Black - Coloured	40.65	59.35
Black - White	39.81	60.19
Coloured - White	28.02	71.98

Sourced: Author's calculations.

Table A3: Correlation Between Education and Age by race

Education	Black	Coloured	White
Level Of Education	**Age**	**Age**	**Age**
Some Primary	0.258	0.140	-0.0173
Completed Primary	0.091	0.229	-0.020
Some Secondary	-0.045	0.091	0.127
Matriculation	-0.280	-0.244	-0.107
Higher	0.1404	-0.072	0.012
N	7142	439	1365

Sourced: Author's calculations.

Table A4: Effect of Education Attainment in Determining ISEI index

Characteristic	Black		Coloured		White	
Education Level						
Some Primary	-0.214		2.416		10.355	***
	(0.423)		(2.087)		(2.596)	
Complete Primary	-0.076.		0.498		-9.134	***
	(0.476)		(1.957)		(2.825)	
Some Secondary	0.846	**	5.541	***	-7.536	***
	(0.427)		(1.839)		(2.624)	
Grade 12/ Std 10	2.835	***	7.355	***	-3.115	
	(0.497)		(1.825)		(2.619)	
Higher	13.344	***	16.568	***	6.738	**
	(0.863)		(2.396)		(2.723)	
Experience						
5 to 15 Years Experience	0.605		0.523		0.142	
	(0.471)		(1.599)		(0.140)	
15 to 25 Years Experience	2.019	***	2.294		0.467	
	(0.523)		(2.176)		(1.614)	
More than 25 Years Experience	1.910	***	-0.377		2.507	
	(0.467)		(2.690)		(1.872)	
Demographics						
Age	0.0151		-0.039		0.079	*
	(0.015)		(0.065)		(0.040)	
Married	0.961	***	2.614	**	1.047	*
	(0.301)		(1.244)		(1.060)	
Male	0.348		-0.811		-7.825	***
	(0.521)		(1.757)		(1.087)	
Firm Characteristics						
Industry and Medical	No		No		No	
Constant	27.853	***	22.334	***	44.533	***
	(1.001)		(3.211)		(3.284)	
R^2	0.118		0.189		0.195	
N	6112		369		1146	

Note: Each regression contains year started employment, married, male, and log of GDP Growth rate variables. Robust standard errors are in parenthesis.

*Significant at the 10 % level

**Significant at the 5 % level

***Significant at the 1 % level

Sourced: Author's calculations.

Table A5: Ordered Probit Regression on Occupational Attainment

Characteristic	Coefficient		Standard Errors	p-value
Race				
Coloured	-0.354	**	(0.160)	0.027
White	0.418	***	(0.070)	0.000
Education Level				
Some Primary	-0.032		(0.089)	0.721
Complete Primary	-0.058		(0.101)	0.567
Some Secondary	-0.039		(0.087)	0.653
Grade 12/ Std 10	-0.033		(0.098)	0.741
Higher	1.421	***	(0.153)	0.000
Location				
Eastern Cape	-1.304	***	(0.439)	0.003
Northern Cape	-1.227	***	(0.291)	0.000
Free State	-0.669	**	(0.292)	0.022
Kwazulu-Natal	-1.191	***	(0.347)	0.001
North West	-0.894	***	(0.291)	0.002
Gauteng	-0.820	***	(0.295)	0.005
Mpumalanga	-1.004	***	(0.294)	0.001
Limpopo	-1.454	***	(0.295)	0.000
Demographics				
Age	0.214	***	(0.080)	0.008
Married	0.193	***	(0.059)	0.001
5 to 15 Years Experience	0.159	*	(0.083)	0.054
15 to 25 Years Experience	0.473	***	(0.095)	0.000
More than 25 Years Experience	0.273	***	(0.059)	0.008
Goodness-of-fit				
Log-likelihood	-3633.8141			
Wald chi^2 with 20 df	633.79			
Pseudo R^2	0.0922			
N	2973			

Note: The regression contains Age^2, Age^3, Male and year of survey control variable as well. Robust standard errors are in parenthesis.

*Significant at the 10 % level

**Significant at the 5 % level

***Significant at the 1 % level

Sourced: Author's calculations.

Table A6: Marginal Race Effects

Dependent Variable	Labourer	Banksmen	Blaster	Driver	Engineer
Predicted Probabilities					
P (Y=1|Black = 1)	0.405	0.359	0.051	0.155	0.031
P (Y=1|Coloured =1)	0.545	0.313	0.036	0.093	0.013
P (Y=1|White = 1)	0.255	0.363	0.065	0.244	0.073
Race Effect					
Coloured Effect	34.60%	-12.73%	-29.31%	-40.00%	-57.47%
White Effect	-37.02%	1.16%	28.28%	57.44%	138.52%

Notes: Other variables in regressions are taken at their means. These variables include Age, Age^2, Age^3, education, categorical experience levels, province, male and year.

Sourced: Author's calculations.