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Jeanne Cilliers[†] and Johan Fourie[‡]

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Abstract

In the absence of historical income or education data, the change in occupations over time can be used as a measure of social mobility. This paper investigates intergenerational occupational mobility using a novel genealogical dataset for settler South Africa, spanning its transition from an agricultural to an early industrialized society (1800–1909). We identify fathers and sons for whom we have complete information on occupational attainment. We follow a two-generation discrete approach to measure changes in both absolute and relative mobility over time. Consistent with qualitative evidence of a shift away from agriculture as the economy’s dominant sector, we see the farming class shrinking and the skilled and professional classes growing. Controlling for changes in the structure of the labor market over time, we find increasing upward social mobility, becoming significant following the discovery of minerals in 1868. We find this mobility particularly for semi-skilled workers but virtually no improved mobility for sons of farmers. We also test hypotheses related to the mobility prospects for first-born sons and sons of immigrants.

Keywords: Intergenerational mobility, social mobility, resource curse, industrialization, colonialism, longitudinal data

JEL codes: J60, J61, J62, N30, N37

1 Introduction

Industrialization is expected to maximize the efficiency of human capital by putting the ‘right man’ in the ‘right place’ (Landes 1969, p. 10). A universal

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consequence of industrialization is said to be the evolution of social stratification systems from being predicated almost entirely on ascription by birth to being predicated on personal achievement (Hoogvelt, 1978). We test this assertion by measuring white social mobility during South Africa's industrial take-off.

For much of the nineteenth century, the territories that made up South Africa were largely agricultural. Cape Town and to a lesser extent Port Elizabeth were the only manufacturing centers. This changed with the discovery of diamonds in 1867 and twenty years later with the discovery of gold in the South African interior, shifting the locale of economic power from the south-eastern coast to the northern interior.

We would like to know more about who benefited from the shift in economic prosperity. We know that the mineral revolution resulted in ethnic inequalities – we can see this for example in the improvement and then spectacular decline of the Basotho economy (Bundy, 1979). Whites, who held the political power in the four states that would in 1910 become the Union of South Africa, clearly benefited most from the diamond and gold boom. We know about the opulence of the Randlords and we have rich social histories of individuals and cultural groups (Davenport, 2013; Flint, 2009; Giliomee 1987; Van Onselen, 2001), but we do not really know who the main economic beneficiaries of South Africa's mineral revolution and consequent industrial take-off were.

Using a novel dataset of genealogical records, we make the first attempt to measure the social mobility of white South Africans during this revolutionary period in the country's economic history. We find that farmers were less socially mobile than unskilled and semi-skilled white laborers. It appears that the changes benefited urban, but not necessarily poor, whites more than they benefited farmers.

This finding contributes to four important topics. First, it contributes to the literature on social mobility by providing new historical evidence of the beneficiaries of South Africa's mineral revolution, the semi-skilled laborers, who were mainly middle-class urban whites (Keegan 1987; Van Onselen 2001). Poor whites seem to have largely been left behind. Because we have no evidence yet on the social mobility of black South Africans during this period, we recognize that our finding may be partly due to the downward mobility of black farmers into unskilled occupations. Not all South Africans were socially mobile: industrialization in South Africa did not turn white farmers into factory-workers. Urban dwellers experienced upward achievement-based mobility, but farming remained highly ascriptive, being based on property rights and land ownership. In the rapidly changing South Africa of the late nineteenth century, patrimony, it seems, still mattered.

Second, it contributes to an emerging literature on intergenerational mobility between and within countries over the past two centuries (Blanden, 2013; Dribe et al., 2015; Long and Ferrie, 2007, 2013; Maas and Van Leeuwen, 2002). Almost all these studies, though, compare the historical intergenerational mobility of present-day developed countries; for obvious reasons: interest in understanding how these countries grew prosperous, and availability of data. The United States, Britain and Sweden have exceptionally rich data sources to support

such high-quality empirical work. Our study is one of the first to measure historical intergenerational mobility in a present-day developing and African country (Patrizio 2014; Pérez 2015).

Third, it contributes to the debate on the effects of a mineral boom (Allcott and Keniston, 2014; Van der Ploeg, 2011). As far as we know, we are the first to measure intergenerational mobility during a period of mineral discoveries. The rapid pace of economic transformation ignited by the discovery of diamonds and gold during the late nineteenth century makes South Africa a unique case study of mobility during mining development and then industrial take-off. We show that when a society moves rapidly from agriculture to industrialization not everyone benefits equally. The institutional features of the society before industrial take-off – both the formal legislative rules and the informal socio-cultural values – can prevent certain groups from experiencing social mobility.

And fourth, it contributes to debates about the role of settler migration and colonialism in Africa (Acemoglu et al., 2001; Fourie and Von Fintel, 2014; Robinson and Heldring, 2014; Meier zu Selhausen and Weisdorf 2016). We find that the main beneficiaries of the mineral revolution were middle-class whites, mostly emigrants from the colonial ruler. The chance of improved social mobility in the colonies probably explains their decision to emigrate, and it also explains the increasing antagonism between these newcomers and the earlier settlers, who were predominantly rural and of Dutch origin (Dugmore, 1999; Fedorowich, 1991).

In our study, to control for the rapid change in the structure of the economy, we use discrete measures of absolute and relative social mobility. Structural changes in the labor market by definition cause intergenerational occupational mobility. Absolute mobility is therefore defined as mobility resulting from changes in the structure of the labor market. Relative mobility, on the other hand, is intergenerational occupational mobility that is net of changes in that structure. Relative mobility could have various causes, such as a reduction of the barriers to mobility, an expansion of the educational system offering new opportunities to the less affluent, the diminishing importance of social networks, or the growing importance of achievement over ascription by birth – this last influenced by the changing formal and informal institutions of the society. Both measures, absolute and relative, provide a description of changes in the relationship between occupations across generations and the share of individuals who remain immobile or end up in higher or lower classes than their parents; in other words, an overall change in social structure.

It should be noted that measures of intergenerational occupational mobility do not necessarily give us a picture of improvements in living standards from generation to generation. Because there can be considerable variation in income and wealth within occupations, in the absence of occupational mobility there may still be substantial income or wealth mobility.

We investigate both absolute and relative social mobility in South Africa before and after the mineral revolution that transformed the country from an agricultural to an industrialized society. We examine patterns of intergenerational social mobility and class attainment during the nineteenth century and

the early years of the twentieth (1800–1909). Our aim is to answer three questions: Was there a long-run trend towards increased intergenerational mobility among European settlers in South Africa during industrialization? To what extent was this trend the result of structural changes in the labor market? Which members of society benefited most from these changes?

2 Social mobility and industrialization

Social mobility, the movement of individuals between social strata, is attributed to factors such as general economic development, industrialization, and improvements in people’s education, occupation and income. Industrialization is thought to bring changes in both social stratification and mobility within the strata (Grusky, 1983; Treiman, 1970). Social mobility depends not only on the stratification system but also on the flexibility of the labor market. Bourdieu et al. (2009) note that the likelihood of becoming a farmer decreases largely because of the labor market moving away from agriculture, whereas the likelihood of being employed in a skilled profession increases not so much because of a change in the labor market as because of increased availability of high quality education. Stratification and status attainment are closely interrelated. To investigate this relationship, a suitable measure of socio-economic status must be found.

We can measure this status either by using discrete categories, such as membership in hierarchically ordered classes, or continuously, using earnings, income or wealth (Bowles and Ginitis, 2002). Economists typically prefer to use continuous measures, but in this study we use discrete measures, which have been the preferred approach in the sociological mobility literature. The discrete approach, using the probability of moving from one social stratum to another, has the advantage of giving a good picture of intergenerational mobility, but the downside is that interpreting the picture is not always straightforward (Erikson and Goldthorpe, 1992).

The continuous approach, using the correlation between the social status of successive generations, provides a simpler measure of social mobility. Modern studies have typically taken this approach because of the availability of comprehensive panel data, with economic status usually available in a variety of convincing measures. Such data allow us to compare income (earnings or wealth) from one generation to the next by estimating intergenerational income elasticities (IGEs). These range from 0 to 1 (from a higher to a lower level of intergenerational mobility). Studies of the earnings of fathers and sons today commonly estimate an IGE of between 0.3 and 0.4.¹

Some studies have used historical mobility to predict future mobility (for example Piketty, 1995), while others have demonstrated how past mobility can explain the persistence of social inequality (Bénebou and Ok, 2001; Bowles and

¹Solon (1999) reviews these studies and Mazumder (2005) provides more recent evidence that they may underestimate the true elasticity.

Ginitis, 2002). These studies are not without their limitations: a common criticism is that income is a one-dimensional measure of socio-economic status. Observed variation can, for example, often be explained away by measurement error (Lechtenfeld and Zoch, 2014). Most importantly for our purposes, however, this method can rarely be applied in historical studies because income data are lacking. But historical registries are often rich in alternative measures of socio-economic status that can be traced across many generations.

In studies of intergenerational occupational mobility, usually calculated between fathers and sons, increased likelihood of moving between discrete occupational categories is seen as evidence of increased social mobility.² Although the main question in this literature has always been whether or not there has been more mobility over time, recent studies have turned to examining differences in social mobility across countries at various stages of economic development and industrialization (Bourdieu et al., 2009; Long and Ferrie, 2013).

Early studies, notably Lipset and Zetterberg (1959), find the general patterns of social mobility across the industrial societies of various Western countries to be much alike. And Erikson and Goldthorpe, in their seminal work *The Constant Flux* (1992), come to a similar conclusion. Ganzeboom et al. (1989) conclude differently, however, finding substantial differences in relative mobility between countries. More recent empirical studies have also contradicted the Lipset and Zetterberg conclusion, finding significant differences between industrialized societies (Van Leeuwen, 2010).

In one such study, comparing intergenerational occupational mobility in Britain and the United States, Long and Ferrie (2013) find significant differences, even after accounting for differences in these countries' occupational structures during the second half of the nineteenth and the first half of the twentieth century. They find, however, that by the second half of the twentieth century the United States had lost its mobility advantage. Bourdieu et al. (2009, p. 526), in a similar analysis comparing France and the United States, find significantly higher mobility rates for the United States during the mid-nineteenth century, possibly caused by variation in political systems, movement of wealth from one generation to the next, the composition of the population, and willingness to invest publically in education.

Large within-country differences can also exist, especially along geographic or racial lines. In ongoing work, Collins and Wanamaker (2013) compare the intergenerational mobility of blacks and whites in the late nineteenth- and early twentieth-century United States, a period of rapid economic transformation. They find that southern whites were much more likely than blacks, conditional on fathers' status, to be upwardly mobile and less likely to be downwardly mobile.

²Van Leeuwen (2009, 2010) reviews the leading studies on historical intergenerational occupational mobility.

3 The history of industrialization in South Africa

To investigate the prospects for social mobility at a time when the South African settler economy was undergoing substantial transformation, we divide the period into four phases. This gives us four cohorts according to the birth dates of the sons in our father-son pairs, capturing four periods of industrialization, which for simplicity we call the ‘slavery’ period (1806–1834), the ‘stagnation’ period (1835–1867), the ‘diamonds’ period (1868–1886) and the ‘gold’ period (1887–1909).

Slavery (1806–1834)

From its arrival at the Cape in 1652 until the first British occupation in 1795, the Dutch East India Company (*Vereenigde Oost-Indische Compagnie*) monopolized trade at the Cape. During those years it was never in the VOC’s mandate to promote secondary industry: it strongly opposed the establishment of manufacturing operations on the grounds that this would be detrimental to its factories in Holland (Fourie, 2013; Lumby, 1983). Under VOC control, wheat and wine production expanded until the latter part of the eighteenth century after which pastoralism dominated, particularly on the eastern frontier (Fourie, 2014; Van Duin and Ross, 1987).

When the Cape Colony came under British mercantilist rule in 1795, it was required to supply the mother country with raw materials and agricultural produce in exchange for manufactured goods. A brief interlude between 1803 and 1806 saw the Cape handed back to the Dutch but by 1806 the Colony was once again incorporated into the British imperial economy. In the 1820s some 4,000 British settlers migrated to the eastern regions of the Colony and in the following decades many of them became sheep farmers or worked as traders and artisans in the newly established towns of Grahamstown and Port Elizabeth. Their frequent trade with the native African population and success in stock farming made the region an economic growth point.

The core of the labor force on most settler farms up to the early nineteenth century, especially in the more productive and densely populated areas of the south-western Cape, was made up of slaves. But the early decades of the nineteenth century saw a steady trend away from slavery, as wage labor became increasingly prevalent with the employment of the indigenous Khoesan in the frontier regions of the Colony (Newton-King, 1999). Ross (1986) suggests that during this period the system of slavery was operated in an increasingly commercialized and capitalist environment and the Khoesan had been ‘sufficiently proletarianized’ to form the basis of what would become a wage labor force. The abolition of slavery in 1834 is often cited as one of the causes of the organized mass migration into the interior by frontier settlers, known as *voortrekkers*, who had become dissatisfied with British rule.

Stagnation (1835–1867)

In the late 1830s, following Britain’s loss of its American colonies, a new policy of free trade was gradually coming into effect. Although it did not prevent the Cape from trading with other countries, it was a system of preferential duties for the protection of British trade and shipping. By this time, Cape Town was

home to some 70 manufacturing concerns, including 15 brickfields, 9 fish-curing firms, 7 steam flour mills, 6 soap and candle factories, 6 snuff mills, and 5 iron and brass foundries. Nearly all the districts of the Colony had some enterprises turning out either agricultural products or manufactures to supply local needs, such as wagon building, furniture making, brick making and stone quarrying (Lumby, 1983).

But the early years of the 1860s saw a period of economic recession in South Africa. The construction of the Suez Canal was causing fears that the opening of the canal would substantially reduce the profits to be made from trade. In addition, the international price of wool, the Colony's only export of real significance, had dropped dramatically after the end of the American civil war (Goodfellow, 1931). The poor economic outlook was compounded by a severe drought which affected large parts of the country (Nattrass, 1981). According to the census of 1865, the economy was still predominantly agricultural. Of the total working population, only 8.5% were employed in manufacturing and 4.4% in commerce, as opposed to 55% in agriculture.

By the mid-nineteenth century, the necessary market, skill and capital were not yet available for industrialization to truly begin, but Ross (1986) maintains that Cape agriculture, in most parts of the rural areas dominated by settlers, could be characterized as 'capitalist' well before the mineral discoveries that were to transform the political economy of the country. Agricultural production throughout the Cape Colony, and to a lesser extent in Natal and the southern Orange Free State, was largely geared to the market, and indeed to export trade. Substantial amounts of credit were available for agricultural investments, first through merchant firms and wealthier families (Swanepoel and Fourie, 2015) and later as country banks were established throughout the territory. Morris (1976, p. 283), in contrast, has argued that when capitalist mining was introduced in the late nineteenth century, 'although a rudimentary exchange economy existed, [with] quasi-feudal peasant relations as the principal means of extracting a surplus in the absence of a strong capitalist farming class, the dominant mode of production in agriculture was not yet capitalist'. This may well have been the case for the Transvaal and the northern Orange Free State, which were the backwaters of colonial South Africa before 1870 and had in common a tendency to accumulate land and exercise patronage as a means to higher social status. The manufacturing industry before 1886 in the Transvaal remained underdeveloped because the huge distances between the farms made specialization and commercial trade impractical (Goodfellow, 1931).

Diamonds (1868–1886)

Mineral discoveries marked the beginning of the industrialization of South Africa's agrarian economy. The first discoveries came from the copper mines of O'okiep in Namaqualand in 1852, the first parcel of diamonds was sent to Europe in 1867, and the goldfields of the Witwatersrand were proclaimed in 1886.³ The Namaqualand copper deposits did not create spectacular wealth

³For a more detailed analysis of the effects of diamond discoveries on the South African economy, see Worger (1987), and for gold, see Gilbert (1933), Katzen (1964) and Webb (1983).

for the exploiters, even though by 1860 copper had become the second most important export after wool (Webb, 1983).

Diamonds and later gold, however, led to the creation of industries directly related to mining, such as those for producing explosives and cement, and to the establishment of certain branches of engineering (Lumby, 1983). Within a year of the 1867 discovery of diamonds in Kimberly there was a burgeoning market not only for labor but for every necessity and convenience of life to support the town's growing population. While the agricultural sector was slow at first in gearing itself to meet the new demand, there were new opportunities for individuals to profit from. A good living could be made for instance by providing ox wagon transport (Webb, 1983). Indeed, before the railway link between Wellington and Kimberly was completed in 1885 there was no alternative to oxen for transporting equipment and materials to and from the mines, a journey which could take weeks to complete (Gilbert, 1933).

More recent scholarship suggests that the completion of the railway link had important implications not only for the expansion of the interior economy but also for South Africa's ability to compete internationally. Using agricultural prices, Boshoff and Fourie (2015), show that South Africa's integration into the global market had already begun in the 1870s, with local wheat prices beginning to follow international trends. Fourie and Herranz-Loncán (2015) add to this by showing that the railway was responsible for at least half of the increase in labor productivity between 1873 and 1905.

Gold (1887–1909)

Following the discovery of the main Witwatersrand reef in 1886, South African gold mining expanded rapidly. Noted South African historian C.W. de Kiewiet once remarked that: 'From 1886 the story of South Africa is the story of gold' (Ally, 1994, p. 1). As early as 1888 there were already 44 producing companies and output increased by 4,000% between 1886 and 1889 (Gilbert, 1933). Breakthroughs continued to be made as new depths were reached with improved machinery and new mining technologies. The completion of a second rail link from the Cape to the Transvaal and thereafter to Delagoa Bay brought more prosperity. The railways provided a market for coal and a demand for electricity and steel and integrated the regional economies, centering on the Witwatersrand (Illife, 1999).

The remaining years of the nineteenth century, however, saw little expansion in general manufacturing, arguably as a result of the absorption of available capital and labor into the mining sector, coupled with a geographically dispersed population which made large-scale manufacturing impossible due to the lack of markets (Lumby, 1983). By 1896 the economy was in recession and this would continue to the end of the century.

Gold output increased steadily during the last few years of the nineteenth century, but the Second South African War (the Anglo-Boer War) halted nearly all mining until 1902. A short-lived post-war boom was followed after 1903 by several years of slow growth and even recession, due largely to the scarcity of mining labor (Gilbert, 1933, p. 560). Despite the war, however, the manufacturing sector grew. From 1890 to 1910 the number of factories increased from 550

to 1,500, and in 1911 the total gross output was valued at £17 million (Lumby, 1983, p. 199). It has been suggested that much of this growth was a result of the cyclical recovery from the South African War.

In sum, diamonds at Kimberley and gold on the Witwatersrand transformed the economy in the space of 50 years. The period 1868–1910 saw the country evolve from almost total dependence on agriculture into a modern economy based on a highly profitable mining industry and supported by an infant manufacturing sector and growing commercial and service industries (Nattrass, 1981).⁴ This is also reflected in the rudimentary estimates of Gross Domestic Product that is available for the Cape Colony: in the sixty years between 1806 and 1865, Fourie and Van Zanden (2013) estimate a decline in GDP per capita. In the thirty years following the discovery of diamonds (1867–1896), they estimate an increase in GDP per capita of 1.9% per annum.

4 Constructing the sample

We use a sample of males from the South African Families (SAF) database (Genealogical Institute of South Africa, 2014),⁵ taking an individual’s occupation as our measure of socio-economic status. Reported occupations were coded into the Historical International Standard Classification of Occupations (HISCO) (Van Leeuwen et al., 2002) and then classified according to the Historical International Social Class Scheme (HISCLASS) (Van Leeuwen and Maas, 2011). Although this classification was initially developed for Europe, it has been applied in other colonial settings as well (Meier zu Selhausen 2014). The 12 HISCLASS groups were re-categorized into five broader classes: professionals, skilled workers, semi-skilled workers, farmers and fishermen, and low and unskilled workers.

As our interest was in intergenerational status attainment, we needed to know the occupation of an individual and his father in order for the pair to be selected into the sample. We observe 9,484 father-son pairs with complete occupation and birth date information during the period of interest. An unfortunate limitation is that the data do not follow individuals who emigrated from South Africa. The socio-economic mobility of these geographically mobile individuals may have differed from those who remained behind, and ought therefore to be considered separately.

To determine how representative this sample of males is of the full population, we compared the records for the sample with available census records. This posed some difficulties. One was that the only available census figures are those reported in the Blue Books for the Cape of Good Hope, for the years 1845, 1865, 1875, 1891 and 1911. The Blue Books provide a crude gauge of the share of individuals employed in different sectors of the economy, but they apply only to the Cape Colony and not the territory as a whole. Another was

⁴For more detail on South Africa’s industrialization, see Illife (1999) and Verhoef (1998).

⁵A full account of this extraordinary genealogical database of South African settler households is provided in Cilliers (2016).

that it was difficult to compare the sample with these censuses accurately for any occupational category other than farmers because definitions varied. Occupational categories in the census change over time and it is not possible in some instances to identify which occupations made up certain categories.

Fortunately the category ‘agriculture’, defined in the census as ‘persons engaged in agricultural employment: possessing, working, or cultivating land, or raising and dealing in livestock’, is reported consistently over time. We can therefore compare this group directly with the ‘farmers’ group in our sample if we restrict the sample to father-son pairs who lived in the Cape Colony and not in other parts of the country. The 1845 census of the Cape of Good Hope offers only a rough estimate of the number of persons engaged in agriculture, reported as two thirds of the European working age population. Later censuses are slightly more reliable. According to those for 1865 and 1875, the economy was still predominantly agricultural. Of the total working population of European men, 55% and 54% were employed in agriculture for those two years respectively. By 1911, this figure had fallen to 46%. These figures appear to be in line with the proportions of farmers reported in the SAF sample for the four periods under observation (see Table 1).

Since no evidence of the occupational structure for the rest of the country is available, we have nothing against which to judge the representativeness of the full SAF sample. We were therefore obliged to limit this study to the Cape Colony, where oversampling of the farming class is less of a concern. This gave us a sample of 5,378 father-son pairs for the period of interest.⁶

The sample sizes for all occupational groups according to period are shown in Table 2. It is clear that only a small amount of change in the structural composition of the labor market took place in the first two periods (the ‘slavery’ and ‘stagnation’ cohorts). Given the previous account of these periods, we would not expect to find substantial mobility during this time. We see a reduction in the size of the farming class over time, gradually at first, from roughly three quarters of the sample in the ‘slavery’ period to less than half in the ‘gold’ period. We also see movement into the professional and skilled classes from the farming and semi-skilled groups. This is an early indication of the upward occupational mobility that would have taken place as a result of the changing structure of the labor market. That the low and unskilled class remains small over time is not surprising, given that these occupations were typically filled not by whites but by other race groups.

Studies of intergenerational mobility typically measure occupational attainment at a specific time in an individual’s life (usually between the ages of 25 and 45). A further difficulty we had with our data is that in some cases several occupations were recorded for an individual throughout his life but no dates or ages were associated with these entries. Occupations are, however, listed chronologically, so it is possible to distinguish between the different occupations an individual may have held over his working life.

⁶All the results were replicated for the full sample and the full results can be obtained from the authors. They should be interpreted with caution as their representativeness of the entire population has not yet been established.

To discover whether any life-cycle effects are likely to confound the results, we looked at the proportions of individuals for whom an occupational class was their first occupation and for whom a class was their highest occupation (see Table 3). Not unexpectedly, we observe a small amount of upward intra-generational mobility. A slightly larger proportion of individuals start their careers as farmers and low skilled workers than the proportion for whom these are the highest achieved occupational classes. And a slightly smaller proportion of individuals start their careers as professional, skilled or semi-skilled workers than the proportion for whom this is the highest achieved occupational class. For simplicity, in our analysis we used the highest social class attained by an individual.⁷

5 The method of measurement

Since the discrete approach to measuring occupational mobility uses the probability of moving from one occupational category to another, to get an accurate comparison of intergenerational mobility across different periods we must compare two tables. Consider a table which compares the occupations of sons with the occupations of their fathers, for each of the four periods, with each period containing a different sample of father-son pairs. While this table would reveal how much mobility actually occurred between successive generations, it would not answer two other important questions: How much mobility would have occurred if the distribution of occupations remained the same across time? How strong was the overall relationship between fathers' and sons' occupations?

To answer the first question, Altham and Ferrie (2007) suggest adjusting the marginal frequencies of one table to match those of another, and to answer the second, adopting a summary measure of overall mobility and a measure of how mobility differs across two tables. The cross-product ratio for a two-dimensional table, or a function of multiple cross-product ratios in a table of more than two rows or columns, is the measure of association in the table, and this measure is invariant to the multiplication of entire rows or columns by arbitrary constants. This allows us to multiply the rows and columns of a table by arbitrary constants without altering the underlying association between rows and columns in the table.

Deming and Stephan (1940) showed how this mechanism could be adapted for tables with more than two rows and columns, and the Deming and Stephan algorithm can easily be applied to each cohort so that each subsequent period will have the occupational structure of the earliest period imposed on it. Any mobility observed in the subsequent periods can only be the result of differences in relative mobility.

Even after adjusting the marginal frequencies and finding (theoretically) that the difference between two periods is 0, there may still be differences in mobility between two tables. For a table with more than two rows or columns, there will be many cross-product ratios, so a summary measure of association is needed to

⁷It should be noted that the use of first occupation did not significantly alter the results.

take account of all of them. The Altham statistic is one such measure (Altham, 1970; Altham and Ferrie 2007).

Our full empirical analysis that follows is carried out in four steps: absolute mobility is calculated using discrete category descriptive tables; relative mobility is distinguished from absolute mobility by adjusting the marginal frequencies of the tables to see how much mobility would have occurred if the distribution of occupations remained the same over time; Altham statistics are calculated to measure the strength of the overall relationship between fathers' and sons' occupations; and multinomial logistic regressions are performed to allow for the inclusion of additional control variables.

6 Analysis of intergenerational mobility in nineteenth-century South Africa

We initially limit our analysis to individuals born in the Cape Colony, the region longest settled by European settlers. We do this to reduce the likelihood of including a biased sample of individuals who migrated in the late 1830s into the interior where there was likely to be underreporting of the descendants of these settlers owing to poorer record-keeping practices (by churches, for example) and poorer infrastructure. While this may limit our ability to measure the intergenerational mobility of regions close to the Witwatersrand gold mines, we want to avoid sample selection driven results. As we show in the final analysis, though, mobility in the Cape Colony was not systematically different from mobility measured in the Transvaal.

For simplicity we summarized the full 5 by 5 transition matrices according to sons who experienced 'downward mobility', 'no mobility' or 'upward mobility' in relation to their father's occupation. The result is shown in Table 4. In the 'Slavery' cohort, a surprising 85% of sons of farmers are farmers themselves, while only 13% move into higher classes. This figure remains largely unchanged at 83% for the 'Stagnation' cohort. But in the 'Diamonds' cohort, with 'no mobility' down by more than 9%, nearly a quarter of the sons of farmers achieve higher occupational outcomes than their fathers.

It is only in the 'Gold' cohort, where the effects of the country's industrialization begin to be felt, that 'no mobility' for farmers drops markedly, to 64%, with one third of sons of farmers now experiencing upward social mobility in absolute terms. While this is an 18 percentage point improvement in the rate of upward mobility between the 'Slavery' and 'Gold' cohorts, it is perhaps not as large as we would expect given the transformation that was going on in the economy.

In Table 5 we again compare mobility over time, but now holding the occupational structure of the society constant. We now see sons of farmers experiencing virtually no improvements in relative mobility throughout the four periods. Within the farming community, it seems that ascription by birth trumped personal achievement, possibly because of the importance of social networks, but

much more probably because of land ownership. Indeed, the possession of physical capital in the form of land may have been far more important than human capital. Productive land would have been highly valued and not parted with easily. Those born into the farming class were on the one hand fortunate because they were saved from falling into the ranks of wage laborers, but unfortunate on the other because they were deterred from seeking to improve their lot.

We should note, of course, that variation in income and wealth within occupations, particularly within the farming class, is likely to have been quite large, so in the absence of occupational mobility there may still have been substantial income or wealth mobility. There were certainly great differences in how much land farmers owned. Some were able to accumulate large stretches of land and, with it, influence and patronage. Others owned only small subdivisions of farms that by themselves were insufficient to ensure families their independence. The situation of farmers in those days is well described by Keegan (1987, p. 20):

By no means were all Boers landowners in the nineteenth century, or wished to be given the fluidity of the pastoral and hunting economy. Non-landownership was not necessarily an economically disadvantageous condition while the Boer economy required and allowed great mobility and an ill-defined sense of proprietary right. Land was always a highly desirable commodity in speculative terms, and land accumulation was a road to status and office in the Boer state, but absentee proprietorship was extensive, farms were ill-defined and un-surveyed, and fencing was non-existent before the final decade or two of the nineteenth century. Non-landownership did not initially entail any disabling economic disadvantages. It was only later – towards the end of the century – that landlessness became a decisive determining factor in the process of class differentiation in Boer society.

Our results show that those who stood to increase their chances of upward mobility most dramatically over time were the sons of semi-skilled workers, many of whom joined the ranks of the skilled and professional classes. In absolute terms the probability of sons of skilled fathers being upwardly mobile more than doubled from 20% in the ‘Slavery’ cohort to 45% in the ‘Gold’ (see Table 4). And the probability of sons of semi-skilled fathers being upwardly mobile more than trebled, from 17% for those born in the ‘Slavery’ cohort to 58% for those born in the ‘Gold’ (see Table 4).

Only part of this improvement can be attributed to a shift in the structure of the labor market making new high-skilled jobs available. The other part of the improvement was unrelated to the structural change, as Table 5 shows. The probability of upward mobility for sons of semi-skilled workers in relative terms increased from 17% in the ‘Slavery’ cohort to 29% in the ‘Gold’ (Table 5). Barriers to entry into white collar positions which required formal training or schooling must therefore have been low for individuals from semi-skilled class origins. This is characteristic of an attainment system based on achievement,

where employers were recruiting into these positions on the basis of merit. Semi-skilled workers, on the other hand, presumably began to invest in the education of their children, enabling them to take advantage of opportunities for upward mobility.

The growth of the professional sector meant that formal education became increasingly important for status attainment as compared with transfer of parents' status or resources (Treiman, 1970). The expansion of public education meant that skills could be acquired in formal schooling. Adult literacy, however, was fairly low in the Cape throughout the century: by 1860 only two thirds of the white population were literate. The Department of Education introduced a number of policies during the 1870s and 1880s to increase white children's access to education, but standards of education remained low and schools were poorly attended. By 1878 more than half of the Colony's white children were still not attending school. Those who did receive a formal education would probably have come from the middle class. The situation is explained by Duff (2011, p. 267):

The Cape's system of education did not cater to the needs or lifestyle of a rural population, which was poor, widely scattered, frequently nomadic, and occasionally suspicious of the motives of the colonial government. This education system was designed to suit a relatively affluent population which was settled for long periods of time, in or near urban centers. This was a model suited for middle-class living – to middle-class parents who were deferential to the authority of civil servants, and who saw the education of their children, and particularly their sons, as absolutely crucial for preparing them for middle-class occupations.

Members of the lowest classes of society rarely had access to this type of formal education and barely literate parents were unlikely to send their children to school (Duff, 2011, p. 266). This is reflected in our finding that the prospects for upward mobility for sons of unskilled laborers remained largely unchanged over time in both absolute and relative terms. Although this was a fairly small group, low skilled and unskilled white laborers were essentially excluded from the general increase in mobility opportunities that existed for other members of white society.

It is thus not surprising that a class of 'poor white' emerged during the last decade of the nineteenth century. Our results support an older historiography that points to the emergence of the 'poor white problem' around this time (De Kock, 1924; Grosskopf, 1932; Fourie 2007), even though these same individuals were perhaps 'hidden' before as unskilled laborers in rural towns or on farms (Bundy, 1984). The rise of larger urban industrial areas made poverty more visible, as the industrial revolution in England had done a century earlier.

The next step of our analysis was to calculate Altham statistics to determine how strong the overall relationship was between fathers' and sons' occupations. The results are shown in Table 6. For simplicity we split the periods into

‘before 1868’ and ‘after 1868’. For both periods we reject the null hypothesis that the occupations of fathers and sons are independent. We also reject the null hypothesis that the relationship between fathers’ and sons’ occupations is identical. The relationship between fathers’ and sons’ occupations in the period after 1868 (Q) is marginally closer to independence than before 1868 (P), which means that the period after 1868 saw greater relative mobility in occupations across generations than the period preceding it. The last statistic, $d^i(P, Q)$ tests the difference between the two tables but now considering mobility off the diagonal. The result is not statistically significant, implying that we cannot reject the null hypothesis of no difference between before 1868 and after 1868 when only considering cells off the diagonal.

An alternative way to measure relative mobility that allows for the inclusion of additional control variables is simply to run a multivariate logistic regression model with the estimated parameters being presented as odds ratios or relative risks. Upward, downward or no mobility are competing outcomes in the model. Controls are included for period of birth and we are able to distinguish relative from absolute mobility by including a variable measuring the relative size of the origin class. This variable measures the share of the population that was observed in the individual’s origin class (i.e. his father’s highest attained occupational class).

Originating from a large or growing class is expected to lower the chances of ending up in a different class, because of the larger number of opportunities in the origin class. Table 7 shows the results of the models which further ratify our discrete table and Altham statistic results. They confirm the increasing absolute and relative upward social mobility over time, becoming statistically significant for sons born after 1868 (the start of the mineral revolution), and the decreasing probability of downward mobility over time, also becoming statistically significant for sons born after 1868.⁸

The multinomial logistic regressions also provide information about the individuals most likely to benefit from the mineral revolution. Table 7 adds two additional explanatory variables: a migrant status dummy taking the value of 1 if the father is a first-generation immigrant and a categorical variable sib rank, which is the number of the son in the household (first sons are the control group).

The coefficient on migrant status is large, positive and significant in all specifications. This implies that the sons of immigrants were more likely to experience social mobility during the mineral revolution than their white compatriots who had been in the country longer. There are various possible reasons for this. Immigrants may have been better educated and thus able to take advantage of the demand for skilled positions opening up in and around the mines. They may have had more access to capital through links to bigger cities. They may have had wider social networks. And non-immigrants may have owned assets

⁸Wald tests reveal that the upward mobility coefficients on 1835–1867 and 1868–1886 are statistically different from one another. The upward mobility coefficients on 1868–1886 and 1887–1909 are also statistically different from one another, while the downward mobility coefficients are not significant.

that delayed their transition into other occupations, as in the case of farmers' career opportunities being limited by land ownership.

To test whether first-born sons, who may have been more likely to inherit land, were less likely to move up in society, we include sib rank as an explanatory variable. The results are insignificant: we found that later-born sons were neither more nor less likely to be socially mobile than first-born sons. The partible inheritance system, in which the spouse of the deceased inherited half of the estate and the children split the other half, may explain this result. Sons of farmers were likely to stay on farms whatever their rank in the family.

In our final analysis, we expand the dataset back to the full 9,484 father-son pairs to include the interior Boer republics of the Orange Free State and the Transvaal and the coastal English colony of Natal. We acknowledge that there is a high likelihood that genealogical information was poorly recorded in these frontier districts, which may introduce sample selection bias into our analysis. Given these selection limitations, in Table 8 we test the effect of location. Residents of the other three provinces all experience more downward mobility than residents of the Cape Colony. Orange Free State residents experience less upward mobility than those in the Cape, while residents of Natal and the Transvaal have levels of upward mobility similar to that of their counterparts in the Cape. These surprising results illustrate the heterogeneous effects of resource booms on a country – even considering the fact that we only include whites. Those in the immediate vicinity of the resource are not necessarily the main beneficiaries.

We also include dummies for the origin country of the settlers in Table 8. This variable is constructed entirely on the basis of the origin of the individual's surname. Individuals with Huguenot surnames, for example, are classified as French, even if their ancestors arrived in South Africa four or five generations earlier. Those with Dutch surnames (the largest group) are the reference group. We find, surprisingly, that individuals with French, German and English surnames all experience higher levels of upward mobility than the others, and perhaps even slightly lower levels of downward mobility. The reasons for this result remain unclear, but a comparison of Model 3 of Table 8 with Model 3 of Table 7 does suggest that controlling for the origin country increases the size of the immigrant status effect while reducing the coefficient on the time dummies. First-generation migrants from Western Europe (with the exception of Holland) seem to have benefited most from the mineral revolution. Whether this was because of human capital advantages, access to capital, more dense business networks, or other reasons, remains a fascinating question for future research.

7 Conclusions

In this study we investigated both absolute and relative social mobility during the early phase of South Africa's transition from an agricultural to industrialized society. To do this we employed several methods, in the aim of providing a comprehensive account of intergenerational social mobility and class attainment

for the Cape Colony over the nineteenth century.

We find increasing upward social mobility over time, becoming significant following the mineral revolution that began in 1868. Consistent with the qualitative evidence of a shift away from agriculture as the dominant sector in the economy, the results show a general shrinking of the farming class and concomitantly an expansion of the skilled and professional class.

However, sons of farmers experienced virtually no improvements in mobility over time, net of these structural changes in the labor market. This is not entirely surprising given the value of the productive land which they would not have parted with easily. It is difficult to imagine that the son of a farmer, who stood to inherit at least some portion of his father's land, would seek out a formal education in order to pursue a career as a doctor or lawyer. Rather, the declining role of agriculture in the economy obliged some sons of farmers to take up a new occupation.

Where all of the mobility for sons of farmers was as a result of the structural changes in the labor market, much of the mobility for the sons of semi-skilled workers was net of these changes. Sons of semi-skilled workers were able to substantially improve their occupational status compared with that of their fathers, as barriers to entry into the upper classes were low for this group.

We also investigated possible explanations for these heterogeneous effects. Location seemed to matter. Cape Colony residents seemed to enjoy higher rates of mobility than residents of regions closer to the mines, notably the Orange Free State and the Transvaal. There could be several reasons for this including lower levels of land ownership, higher levels of human capital and greater access to capital and networks.

These same reasons may explain why immigrant status – whether a person was a first-generation son or not – is another important predictor of upward social mobility. Immigrants, notably those from England, France and Germany, were likely to experience higher rates of upward social mobility and lower rates of downward mobility. Understanding the precise reasons for this greater mobility of middle-class immigrants should be the subject of future research. What our results do show, though, is that the mineral revolution and the consequent industrial take-off fostered achievement-based mobility rather than mobility based solely on ascription.

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Table 1: European or white males in working population with specified occupations employed in agriculture

Period (Cape Colony)	SAF (Cape Colony) sample	Cape of Good Hope census year	Cape of Good Hope census estimate
1806–1834	75%	n/a	n/a
1835–1867	69%	1845	67%
1868–1886	58%	1875	54%
1887–1909	49%	1911	46%

Table 2: Size of occupational groups by period

	‘Slavery’ 1806–1834	‘Stagnation’ 1835–1867	‘Diamonds’ 1868–1886	‘Gold’ 1887–1909	Overall change in proportion*
Professional	8.7	12.9	22.7	29.6	20.9
Skilled	6.8	8.3	11.5	13.4	6.6
Semi-skilled	5.1	5.8	5.1	4.6	-0.5
Farmers	75.2	68.8	57.7	48.5	-26.7
Low/unskilled	4.2	4.2	2.9	3.9	-0.3
Total	100.0	100.0	100.0	100.0	
Cohort size	1,007	2,078	1,179	1,114	5,378

*Positive values indicate that the class grew.

Table 3: Intra-generational occupational mobility

	Percentage of the sample	
	First occupation	Highest occupation
Professional	14.5	18.0
Skilled	9.0	9.8
Semi-skilled	4.5	5.3
Farmers	67.7	63.1
Low/unskilled	4.3	3.8
Total	100.0	100.0
N	5,378	5,378

Table 4: Absolute intergenerational mobility, summarized by birth cohort (percentages)

<i>'Slavery' 1806–1834</i>	Downward	No mobility	Upward
Professional	69.5	30.4	-
Skilled	40.0	40.0	20.0
Semi-skilled	54.7	28.3	17.0
Farmers	2.1	84.7	13.3
Low/unskilled	-	21.1	79.0
All	13.4	72.0	14.6
N	140	751	152

<i>'Stagnation' 1835–1867</i>	Downward	No mobility	Upward
Professional	53.3	46.7	-
Skilled	38.7	32.4	28.9
Semi-skilled	45.7	27.2	27.2
Farmers	3.0	82.8	14.2
Low/unskilled	-	45.1	54.9
All	13.9	70.5	15.6
N	298	1510	335

<i>'Diamonds' 1868–1886</i>	Downward	No mobility	Upward
Professional	42.4	57.6	-
Skilled	34.8	24.1	41.1
Semi-skilled	36.2	23.3	50.5
Farmers	2.9	73.9	23.2
Low/unskilled	-	21.7	78.3
All	13.2	62.0	24.8
N	165	773	309

<i>'Gold' 1887–1909</i>	Downward	No mobility	Upward
Professional	31.1	68.9	-
Skilled	27.9	27.3	44.8
Semi-skilled	15.0	27.5	57.5
Farmers	4.3	64.1	31.5
Low/unskilled	-	25.0	75.0
All	11.3	57.6	31.0
N	140	713	384

**Table 5: Relative intergenerational mobility, summarized by birth cohort (percentages).
Marginal frequencies adjusted to match first birth cohort**

<i>'Slavery' 1806–1834</i>	Downward	No mobility	Upward
Professional	69.6	30.4	-
Skilled	40.0	40.0	20.0
Semi-skilled	54.7	28.3	17.0
Farmers	2.1	84.7	13.2
Low/unskilled	-	21.1	78.9
All	13.4	72.0	14.6
N	140	751	152

<i>'Stagnation' 1835–1867</i>	Downward	No mobility	Upward
Professional	62.9	37.1	-
Skilled	45.8	32.3	21.9
Semi-skilled	50.9	27.9	21.3
Farmers	2.7	86.2	11.2
Low/unskilled	-	43.5	56.5
All	13.1	74.5	12.4
N	137	777	129

<i>'Diamonds' 1868–1886</i>	Downward	No mobility	Upward
Professional	65.9	34.1	-
Skilled	58.4	20.3	21.3
Semi-skilled	40.7	30.4	29.0
Farmers	3.3	84.7	12.1
Low/unskilled	-	28.6	71.4
All	13.8	72.2	13.9
N	144	753	145

<i>'Gold' 1887–1909</i>	Downward	No mobility	Upward
Professional	64.6	35.4	-
Skilled	60.4	21.5	18.1
Semi-skilled	30.5	40.9	28.6
Farmers	3.5	85.4	11.1
Low/unskilled	-	27.5	72.5
All	13.4	73.5	13.1
N	139	767	137

Table 6: Altham statistics

	d(P, I)	d(Q, I)	d(P, Q)	d ⁱ (P, Q)
Before 1868 (P) compared with after 1868 (Q)	32.55***	31.97***	12.96**	10.60

*** p<0.01, ** p<0.05, * p<0.1

Table 7: Multinomial logistic regression with migrant status and sib rank. No mobility as base outcome. Estimates expressed as relative risks

	Model 1		Model 2		Model 3	
	Downward mobility	Upward mobility	Downward mobility	Upward mobility	Downward mobility	Upward mobility
1800–1834	1.000	1.000	1.000	1.000	1.000	1.000
1835–1867	1.135	1.168	0.763*	1.151	0.687**	1.096
1868–1886	1.337**	2.033***	0.629***	2.063***	0.606***	1.908***
1887–1909	1.168	2.567***	0.543***	2.715***	0.533***	2.533***
Migrant status	3.423***	2.662***	0.579***	1.830***	0.518***	1.832***
Sib rank	0.962	0.984	1.195	0.985	1.200	0.989
Origin class size			Yes		Yes	
Father's class					Yes	
Pseudo R2	0.0194		0.2271		0.2305	
Prob>chi2	0.0000		0.0000		0.0000	
Observations	5 378		5 378		5 378	

*** p<0.01, ** p<0.05, * p<0.1

Table 8: Multinomial logistic regression with origin country and provincial dummies. No mobility as base outcome. Estimates expressed as relative risks

	Model 1		Model 2		Model 3	
	Downward mobility	Upward mobility	Downward mobility	Upward mobility	Downward mobility	Upward mobility
1800–1834	1.000	1.000	1.000	1.000	1.000	1.000
1835–1867	1.014	1.075	0.824*	1.018	0.728**	0.959
1868–1886	1.174	1.713***	0.869	1.566***	0.725**	1.414***
1887–1909	1.169	2.681***	0.855	2.407***	0.647***	1.961***
Migrant status (Father non-migrant ref.)	3.509***	2.629***	0.877	1.668***	0.756**	2.028***
Origin country (Netherlands ref.)	1.000	1.000	1.000	1.000	1.000	1.000
France	0.873	1.315***	0.839	1.297***	0.806*	1.362***
Germany	1.132	1.565***	0.970	1.496***	0.936	1.525***
UK	1.888***	1.574***	1.055	1.354***	1.017	1.244*
Other west Europe	1.255	1.221	1.178	1.244	1.377*	1.155
Other east Europe	0.867	0.732	1.054	0.700	1.258	0.596
Unknown	1.049	1.098	0.919	1.070	0.896	1.102
Sib rank (First born son ref.)	1.127	0.982	1.403***	1.039	1.419***	0.994
Province (Cape ref.)						
Natal	1.004	0.895	1.683**	1.021	1.688**	1.021
OFS	0.784**	0.670***	1.221	0.701***	1.299*	0.666***
Transvaal	1.581***	1.092	1.493***	1.052	1.647***	1.027
Origin class size			Yes		Yes	
Father's class					Yes	
Pseudo R2	0.0349		0.1575		0.2305	
Prob>chi2	0.0000		0.0000		0.0000	
Observations	9,484		9,372		9,372	

*** p<0.01, ** p<0.05, * p<0.1